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P-426.02

Paint Lake Provincial Park

Environment Act Proposal

Wastewater Treatment Lagoon Expansion

[redacted]

Prepared by:

[redacted]

Oswald Wohlgemut, M.Sc.
Environmental Scientist

[redacted]

Reviewed by:

Brett McCormac, P. Eng.
Environmental Engineer

October 2022

APEGM
Certificate of Authorization
J. R. Cousin Consultants Ltd.
No. 234 Date: Oct 27/22

JRCC ENGINEERING CONSULTANTS

ACKNOWLEDGMENTS

To prepare this report various sources of information were investigated and researched. JR Cousin Consultants Ltd. (JRCC) wishes to thank the Manitoba Water Services Board and Manitoba Environment, Climate and Parks (MECP) for contributing to the data and content of this study. In addition, we wish to commend MECP for their fortitude in addressing the need for a long-term solution to wastewater treatment for the Paint Lake Provincial Park.

REMARKS

JR Cousin Consultants Ltd. has conducted this environment act proposal in accordance with generally accepted professional engineering principles and practices for the purpose of identifying conditions that may have an environmental impact on the site. The findings and recommendations reached in this report are based on information made available to JRCC during the investigation and conditions at the time of the site investigation. Conclusions derived in this report are intended to reduce, but not wholly eliminate the uncertainty regarding potential environmental concerns on the site, and recognizes reasonable limitations with regards to time, accuracy, work scope and cost. It is possible that environmental conditions may change from the date of this report. If conditions appear different from those encountered and expressed in this report, JRCC should be informed so that mitigation recommendations can be reviewed and adjusted as required. Historical data and information obtained from personal communication used in this report, are assumed to be correct, however JRCC has not conducted further investigations into the accuracy of this data. JRCC has produced this report for the use of the client, and takes no responsibility for any third-party decisions or actions based on information contained in this report.

TABLE OF CONTENTS

Section **Page of Section**

Environment Act Proposal Form

Manitoba

Name of the development:

Paint Lake Provincial Park Wastewater Treatment Lagoon Expansion

Type of development per Classes of Development Regulation (Manitoba Regulation 164/88):

Wastewater Treatment Lagoon - Class 2 Development

Legal name of the applicant:

Manitoba Environment, Climate and Parks, Parks Branch

Mailing address of the applicant: 400 Ellice Ave

Contact Person: Linda Horner

City: Winnipeg Province: Manitoba Postal Code: R3B 3M3

Phone Number: (204) 770-4734 Fax: email: rebecca.lauhn-jensen@gov.mb.ca

Location of the development: Paint Lake Provincial Park

Contact Person: Linda Horner

Street Address: n/a

Legal Description: 75-4-W

City/Town: Paint Lake Provincial Par Province: Manitoba Postal Code: R3B 3M3

Phone Number: (204) 677-7342 Fax: email: linda.horner@gov.mb.ca

Name of proponent contact person for purposes of the environmental assessment:

Brett McCormac, P.Eng.

Phone: (204) 489-0474 Fax:	Mailing address: 91 Scurfield Blvd., Winnipeg, MB, R3Y 1G4

Email address: bmccormac@jrcc.ca

Webpage address: http://jrcc.ca

Date: 2022-10-24	Signature of proponent, or corporate principal of corporate proponent: Printed name: Brett McCormac

PRINT RESET

A complete **Environment Act Proposal (EAP)** consists of the following components:

- ☑ **Cover letter**
- ☑ **Environment Act Proposal Form**
- ☑ **Reports/plans supporting the EAP** (see "Information Bulletin - Environment Act Proposal Report Guidelines" for required information and number of copies)
- ☑ **Application fee** (Cheque, payable to Minister of Finance, for the appropriate fee)

Per Environment Act Fees Regulation (Manitoba Regulation 168/96):

Class 1 Developments	$1,000
Class 2 Developments	$7,500
Class 3 Developments:	
Transportation and Transmission Lines	$10,000
Water Developments	$60,000
Energy and Mining	$120,000

Submit the complete EAP to:
Director
Environmental Approvals Branch
Manitoba Environment, Climate and Parks
1007 Century Street
Winnipeg, Manitoba R3H 0W4

For more information:
Email: EABDirector@gov.mb.ca
Phone: (204) 945-8321
Fax: (204) 945-5229
https://www.gov.mb.ca/sd/permits_licenses_approvals/eal/licence/index.html

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$60,000.....WD B-02
$120,000...EM B-02

EXECUTIVE SUMMARY

General

The Manitoba Environment, Climate and Parks (MECP), Parks Branch is proposing to expand and upgrade the existing Paint Lake Provincial Park wastewater treatment lagoon. An Environment Act Licence will be required from Manitoba Environment, Climate and Parks, Licensing Branch for the construction and operation of the expanded lagoon, sludge relocation and decommissioning of a lagoon cell. JR Cousin Consultants Ltd. (JRCC) was retained for the associated engineering services.

Description

The existing Paint Lake lagoon is in need of expansion and upgrading, due to concerns of organic and hydraulic capacity, and to accommodate potential future expansion of the cottage subdivisions. The proposed works will include expanding the primary cell to the northwest of the existing lagoon cells, transferring sludge from the existing Primary Cell and Storage Cell 2 into the expanded portion of the Primary Cell, and decommissioning Storage Cell 2. These works are required to achieve the organic and hydraulic storage capacities required to design Year 20.

Population Contributing Effluent

The projected year 20 population used for sizing the Paint Lake lagoon expansion consisted of residential populations in the cottage development, campground, lodge cabins, lodge restaurant and wildfire base, for a total of 1,524 people. The population is expected to increase from 1,327 to 1,524 over 20 years which represents an average annual growth rate of 0.74%.

Lagoon Loading

The total projected Year 20 organic loading to the lagoon primary cell is approximately 115.0 kg BOD_5/day, which considers peak daily loading from the piped and truck hauled sources.

Based on the service population and estimated infiltration rate, the 230-day hydraulic load of 30,152 m^3 is projected in design year 20.

Sludge Assessment

A sludge survey of the existing Primary Cell indicated that there was an accumulation of approximately 3,150 m^3 of sludge, with an average sludge thickness of 0.70 m. A sludge survey of the existing Storage Cell 1 indicated that there was an accumulation of approximately 3,699 m^3 of sludge, with an average sludge thickness of 0.39 m. A sludge survey of the existing Storage Cell 2 indicated that there was an accumulation of approximately 732 m^3 of sludge, with an average sludge thickness of 0.33 m.

Geotechnical Investigation

The general area of the proposed lagoon expansion is forested land. The soil profile in the expansion area to the northwest of the existing lagoon cells generally consists of shallow peat followed by high plastic clay to test hole termination 6.0 m below the surface. The existing lagoon dike soil profile in the southwest corner of Storage Cell 1

consisted of high plastic compacted clay from the surface to the bottom of the dike. The clay layer has a hydraulic conductivity of less than 1 x 10^{-7} cm/sec, therefore it would be suitable for construction of a lagoon liner, meeting provincial requirements. Groundwater infiltration was not observed, but wet conditions in the soil were observed at a depth of 3.0 m below the surface in the proposed expansion area.

Lagoon Expansion and Upgrade Design

Based on a review of the projected lagoon organic and hydraulic loadings and the soils investigation of the site, the lagoon expansion will consist of:

- constructing a new primary cell expansion to the northwest of the existing lagoon cells
- Lowering the existing primary cell floor to match the expansion cell
- Decommissioning of Storage Cell 2
- Installing a new discharge pipe from Storage Cell 1
- Installing a new intercell pipe between Storage Cell 1 and the expanded primary cell
- Upgrading the existing truck haul spillway
- Installing perimeter fencing and ditching around the new cell.

Based on the sludge accumulation, it is proposed that sludge be removed from the existing primary cell and Storage Cell 2. The sludge would be pumped or placed into the newly constructed adjacent primary cell expansion. The cell is proposed to be constructed deeper than typical such that the sludge does not impact the 1.5 m liquid depth of the Primary Cell.

Lagoon Liner Design

Based on the results of the soils investigation and laboratory analysis, it is proposed to construct the floor liner of the expansion cell with in-situ (undisturbed) soils, at the desired excavation depth. A vertical cut-off wall of re-compacted soils is proposed for the perimeter cell liner, which would tie into the in-situ cell floor liner. It is expected that the hydraulic conductivity of the liner soils would achieve a hydraulic conductivity value less than 1 x 10^{-7} cm/sec, as required by MECP for containment of liquids. The cell liner will have a minimum thickness of 1.0 m and will form a continuous liner.

Design Considerations

The design considerations of the proposed lagoon expansion will include:

- Expanded Primary Cell depth of 2.8 m (0.3 m of sludge, 1.5 m liquid operating depth and 1.0 m freeboard)
- Inner and outer dike slopes of 4H:1V in the expanded primary cell
- An intercell pipe and valve located in the intercell dike between the Storage Cell 1 and the Primary Cell expansion
- Lowering the floor of the existing Primary Cell by approximately 0.8 m
- A new discharge pipe through the southeast dike of Storage Cell 1
- Decommissioning Storage Cell 2

- A perimeter ditch around the outside toe of the new primary cell expansion
- A barbed wire perimeter fence located along the outside toe of the Primary Cell and Storage Cell 1.

Nutrient Management Plan

Normal facultative lagoon operation with spring and fall discharges, will typically produce effluent quality meeting provincial and federal requirements for BOD, CBOD, TSS, fecal coliforms, E. coli, and un-ionized ammonia. Phosphorus reduction would be achieved through the application of Alum on the surface of the storage cell, if effluent quality does not meet the provincial requirement of 1 mg/L or less prior to discharge. It is requested to sample the phosphorus concentration at the outlet of the existing wetlands rather than outlet of the lagoon as the lagoon utilizes a discharge ditch and natural wetlands for discharge.

Utilizing the natural wetlands is expected to have a positive environmental impact compared to utilizing chemicals as carbon emissions would be reduced without the requirement of transporting chemicals to the site and there would be less sludge generation in the lagoon. Utilizing the natural wetland would also lead to less safety risks to operators as they would not be required to handle chemical or utilize a boat in the lagoon cells.

Potential Concerns and Mitigation Measures

From discussions with the Parks Branch and a review of the current site operations, the potential concerns identified with the expansion of the wastewater treatment lagoon and associated mitigation measures include:

Potential Concern	Mitigation Measure
Emissions from construction equipment	The construction contractor will maintain heavy equipment to meet provincial and local emission standards and minimize idling
Dust generation	Dust suppression methods (i.e., wetting) will be utilized if dry and windy conditions are a nuisance to nearby residents
Odours from lagoon operation and sludge transfer	The expanded lagoon will have a primary cell sized for the peak organic loading in design year 20 and sludge transfer will be short in duration so odours should be reduced with the expanded lagoon
Contamination of surface and groundwater from lagoon discharge and seepage	Lagoon effluent will be treated to the requirements of the Environment Act Licence prior to discharging. The lagoon will utilize a clay soil liner in accordance with provincial requirements for containment of effluent during operation
Soil erosion after construction works	Areas with bare soil outside of the expansion cell and disturbed areas will be seeded with grass to reduce erosion
Siltation of discharge route	Silt fencing will be utilized to reduce silt entering the discharge route
Spills or leaks during construction	The contractor is to have an emergency spill kit on site. Hazardous materials and fuel is to be handled in accordance with all Federal and Provincial regulations
Impacts to Wildlife and Bird Species	The areas to be developed will be clearly marked prior to tree

Potential Concern	Mitigation Measure
	clearing. Works will only occur during daylight hours to prevent unintentional impacts to wildlife and bird species
Reduce aesthetics of area	Slopes will be seeded after construction and the vegetation on the slopes will be maintained regularly to reduce visual impacts
Noise impacts from construction works	Construction works will be limited to daylight hours only. Residents will receive notice of nearby construction schedule
Heritage or historic resources	If any significant historic or heritage resource is discovered during the construction works, the works will temporarily cease and provincial and federal authorities will be notified for an investigation
Public health and safety	Construction workers will be required to adhere to the safety program that will include utilizing personal protective equipment while on site. Access to the construction site will be limited. Warning signs will be utilized at the entrance to the site to prevent unauthorized entry.

Schedule and Approvals

The Parks Branch would like to begin the lagoon expansion design works in 2023, after receipt of an Environment Act Licence and funding is obtained.

1.0 INTRODUCTION AND BACKGROUND

The development described herein is for the expansion of the existing wastewater treatment lagoon, located in the Paint Lake Provincial Park Campground, and for the transfer of sludge in the lagoon cells and cell decommissioning.

1.1 Introduction

Manitoba Environment, Climate and Parks (MECP), Parks Branch (referred to as Parks Branch) has prepared this Environment Act Proposal (EAP) to satisfy the requirements of MECP, Licencing Branch for the construction and operation of an expanded wastewater treatment lagoon in Paint Lake Provincial Park, Manitoba. An Environment Act Licence is required from MECP Licencing Branch for the proposed works. JR Cousin Consultants Ltd. (JRCC) was retained for the related engineering services.

1.2 Contact Information

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Environment, Climate and Parks
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Thompson, Manitoba
R8N 1X4
Phone: (204) 679-2080

1.3 Background Information

Paint Lake Provincial Park is located approximately 36 km south of Thompson, Manitoba along PR 375. The existing wastewater treatment lagoon is located adjacent to the campground and cottage development along Paint Lake (see Plan 1 in Appendix C). The lagoon has an access road from PR 375 to the southwest.

The Paint Lake lagoon was constructed in three phases with Storage Cell 2 built in 1978, Storage Cell 1 built in 1983 and the Primary Cell built in 1989, to service the campground and surrounding cottage development. The lagoon is currently operating under Environment Act Licence No. 1304, issued in 1989. There is a maintenance yard located on the northwest, southwest and southeast sides of the lagoon, with two separate access roads to the lagoon cells. The lagoon receives wastewater from a gravity piped collection system in the campground and truck-haul from the cottage development. The lagoon discharges by pumping from Storage Cell 2 to the north through a shallow buried discharge pipe which

discharges into an open ditch east of the lagoon Primary Cell. The discharge ditch extends approximately 1 km from the lagoon to a natural wetlands.

Due to recent high liquid levels in the lagoon and to allow for potential future expansion to the cottage development, the wastewater treatment lagoon is in need of expansion to meet the long term needs of the Provincial Park.

1.4 Description of Previous Studies

Several documents pertaining to the existing Paint Lake Provincial Park wastewater treatment lagoon were reviewed, including:

- Phase 1 Study of Slope Movement of Sewage Lagoon Paint Lake Provincial Park. Acres International Ltd., 1999
- Correspondence Letter. Manitoba Conservation and Climate, 2021
- Paint Lake Provincial Park Wastewater Lagoon Assessment. JRCC, 2022.

1.5 Project Description

Parks Branch is in need of an Environment Act Licence for the expansion and continued operation of the Paint Lake Provincial Park wastewater treatment lagoon and for the transfer of sludge from the lagoon Primary Cell and Secondary Cell 2 to the new expansion cell. Due to concerns with organic and hydraulic capacity in the existing lagoon, an expanded primary cell is being proposed for construction to the northwest of the existing lagoon cells and sized for the estimated design year 20 organic loading and the 230-day hydraulic storage capacity. The construction works would also involve decommissioning of Storage Cell 2, installation of a new discharge pipe and intercell pipe.

2.0 DESCRIPTION OF THE DEVELOPMENT

For each heading there is an information request from the Environment Act Proposal Form. These requests are repeated herein in italics followed by the pertaining response.

2.1 Land Title/Location

Certificate of Title showing the owner(s) and legal description of the land upon which the development will be constructed; or, in the case of highways, rail lines, electrical transmission lines, or pipelines, a map or maps at a scale no less than 1:50,000 showing the location of the proposed development:

The location for the proposed wastewater treatment lagoon expanded primary cell is within Paint Lake Provincial Park, northwest of (adjacent to) the existing lagoon cells. The provincial park is located approximately 36 km south of Thompson, Manitoba. Location of the proposed expanded lagoon layout is included on Plan 1 in Appendix C. The land parcel to be utilized for the new lagoon cell construction is Provincial Crown Land within Paint Lake Provincial Park.

2.2 Owner of Land and Mineral Rights

Owner of land upon which the development is intended to be constructed, and of mineral rights beneath the land, if different from surface owner:

As the proposed development site northwest of the lagoon is Provincial Crown Land, the mines and mineral rights would belong to the province.

2.3 Existing Land Use

Existing land use on the site and on land adjoining it, as well as changes that will be made in such land use for the purposes of the development:

The land surrounding the existing lagoon cells is native forest land. The Parks maintenance department has used the land on the north and south dikes as a storage area for maintenance equipment and a fuel storage tank is located near the south dike. The proposed development area would need to be cleared of trees prior to excavation, and will be surrounded by forest to the north east and west. The drainage in the development area will be impacted by the perimeter dikes. A perimeter drainage ditch around the new lagoon cell would be constructed to tie into the natural drainage in the area.

2.4 Land Use Designation/Zoning Designation

Land use designation for the site and adjoining land as identified in a development plan adopted under The Planning Act or The City of Winnipeg Act, and the zoning designation as identified in a zoning by-law, if applicable:

The lagoon development land is zoned as a Resource Development, with a Recreational Development Land Use Category, with accommodations for cottage developments, commercial development and associated infrastructure (water and sewer).

2.5 Description of Development

Description of proposed development and schedule for stages of the development, including proposed dates for planning, design, construction, commissioning, operation, and decommissioning and/or termination of operation (if known), identifying major components and activities of the development as applicable (e.g., access road, airstrip, processing facility, waste disposal area, etc.).

2.5.1 Project Schedule

The lagoon expansion detailed design work is currently underway and expected to be ready for tender by March of 2023. The project is planned to be tendered in April of 2023, upon receipt of the Environment Act Licence. Construction is planned to start in spring/summer of 2023. Commissioning and operation of the expanded lagoon would begin upon completion of construction and after approval for use is obtained from MECP, which is planned to occur in fall of 2023. The construction works would be conducted in phases to allow continuous operation of the lagoon. There may be times during construction that the forcemain and/or truck haul would have to be diverted to another cell during construction works.

2.5.2 Lagoon Site Setbacks and Characteristics

The location of the Paint Lake lagoon expansion cell was chosen based on proximity to the existing lagoon cells, the existing infrastructure, surrounding residences, land ownership, existing land use, soil conditions, topography, and proximity to future cottage development. The expansion cell area will be located further from the existing cottages compared to the existing cells.

The MECP guidelines for the location of a wastewater treatment lagoon (*Information Bulletin – Design Objectives for Wastewater Treatment Lagoon*, Manitoba Conservation, 2014) are outlined in the following Table. A description of the proposed expansion site in relation to each of the guidelines is also provided in the table.

Table A: Location of Proposed Lagoon Expansion Site in Relation to Provincial Guidelines

Manitoba Conservation and Climate Guideline	Proposed Relation to Site
Lagoons must be located a minimum of 460 m from the nearest center of population.	The existing and proposed lagoon cells are located further than 460 m from the nearest centre of population
Lagoons must be located a minimum of 300 m from any residence. (Measured from the outer toe of the nearest dike).	The proposed lagoon cell will be located approximately 240 m from the nearest cottage residence
Consideration should be given to sites in which prevailing winds are in the direction of uninhabited areas.	The prevailing winds are typically from the north and west. The existing and proposed lagoon cells are located north and west of the cottage development and campground. Expansion cell area is

Manitoba Conservation and Climate Guideline	Proposed Relation to Site
	limited by the location of the existing cells. The area surrounding the lagoon is forested which should provide a windbreak.
Sites with an unobstructed wind sweep across the lagoon are preferred.	The existing and proposed lagoon cells are surrounded by forest land
Areas that are habitually flooded shall be avoided and locations receiving significant amounts of runoff water are discouraged.	The lagoon cells are not located in a flood plain, and the land proposed for new cell construction is not known for overland flooding. A perimeter ditch will also be located around the toe of the new cell to divert runoff water away.
Sewage lagoons are to be designed and constructed such that the interior surface of the proposed lagoon is underlain by at least one metre of soil having a hydraulic conductivity of 1×10^{-7} cm/sec or less. In areas sensitive to groundwater contamination or without suitable soils, a flexible synthetic liner may be utilized.	As the excavated soils at the site can provide a consistent permeability of less than 1×10^{-7} cm/sec in an unaltered state, the lagoon cells will be lined with a minimum 1 m thick in situ and compacted soil to provide containment of wastewater.

Parks staff indicated that the area of proposed cell development is not prone to overland flooding. The existing and proposed lagoon development area is located within the cottage development residential setback (see Plan 1 in Appendix C). The lagoon has been operating within these residential setbacks for several years and Parks Branch occasionally does receive complaints about odours from the cottagers during the spring thaw period or when trucks are discharging. The lagoon cell is located upwind of the residents, however the surrounding forest acts as a windbreak to prevent odours from extending great distances. The expanded cell will be located further from the existing cottages than the existing cells. A properly sized primary cell should reduce odours from the lagoon as the existing lagoon primary cell is severely undersized.

2.5.3 Land Classification

The application of lagoon effluent is regulated by the Nutrient Management Regulation under the Water Protection Act. The regulation indicates whether there are any limitations to nutrient discharge based on the soil type in the area of discharge, which can be determined from the agricultural capability classification. Based on the existing soil survey report (No. D32) for the area of development, the agricultural capability of the area was not provided, as the area is not agricultural land, therefore a land classification could not be determined. The soil survey report indicated that the site would be suitable for construction of a landfill site, due to low permeability of the soils, which is also required in the construction of a lagoon cell. The lagoon discharges to a nearby wetland which is suitable for absorbing nutrients from lagoon effluent. It is not expected that the continuation of this discharge will have any additional impacts to the

surrounding lands or surface waters. Therefore, the lagoon expansion should not be limited by the Nutrient Management Regulations.

2.5.4 Lagoon Drainage Route

The discharge route follows a drainage channel approximately 1 km north of the lagoon site to an existing wetland. The lagoon expansion would include an alteration of the discharge pipe from the lagoon which will connect to the existing drainage route (see Plan 2 in Appendix C).

2.5.5 Lagoon Access

The existing lagoon is accessed from a granular approach off of the cottage development road. The existing lagoon approach will be unaltered through the proposed expansion works. The truck dump spillway will be upgraded as part of the works. There may be a temporary loss of use of the lagoon approach road while the discharge pipe is re-routed and installed below the approach.

2.6 Population Contributing Effluent

Population data was obtained from Manitoba Parks. The service population currently utilizing the Paint Lake lagoon is limited to seasonally and permanently occupied cabins, campsites, yurts, the Paint Lake Lodge, Park maintenance yard and office, and the Manitoba Wildfire Services base, which also serves as an office for Parks staff during the summer. No other significant rural, commercial or industrial sources of wastewater were reported to be utilizing the lagoon. Based on discussions with Parks, future growth in the area may include some level of additional cottage development and potential expansion at the Paint Lake Lodge. For lagoon expansion sizing it was assumed growth will include fifty new permanently occupied cottages, ten cabins at the Paint Lake Lodge, and an increase of fifteen staff at the wildfire base. This will be used as the only increase in population over the 20-year design period when determining the future organic and hydraulic loading to the lagoon.

2.6.1 Cottages – Permanent Occupancy

Based on discussions with Parks Branch, there are 123 cottages with holding tanks, which have declared permanent residency. Parks Branch indicated there is an average of three people per cottage. An increase of fifty cottages has been included during the next 20 years based on estimates by Parks Branch.

2.6.2 Cottages – Seasonal Occupancy

Based on information provided by Parks, there are eighty seasonally occupied cabins with an average population density of three people per cottage with sewage hauled to the lagoon. No increase in seasonal occupancy was expected in the next 20 years.

2.6.3 Campground - Campsites

The Paint Lake Campground has 192 campsites. The washrooms in the campground for most of the campsites are connected to the gravity sewer system and there are some non-modern washrooms on holding tanks that are pumped out by Parks Branch. The campground is open

from the May long weekend until the second week of September every year. Parks Branch provided the following information on approximate occupancy rates for the campground during the summer season: 40% in May and June, 80% in July, 70% in August, and 30% in September. The peak occupancy of 80% will be used for determining the organic load to the lagoon from the campsites, and it will be assumed that there is an average of three people per campsite as indicated by Parks Branch. There is not expected to be any growth in the campground over the next 20 years.

2.6.4 Campground - Yurts

The Paint Lake Campground has six yurts. The occupancy rates of the yurts are the same as for the campsites. A peak occupancy of 80% was assumed in July, as indicated by Parks Branch, along with an average of three people per yurt. There is not expected to be any growth in population from the yurts in the next 20 years.

2.6.5 Paint Lake Lodge - Cabins

The Paint Lake Lodge is open year-round and is connected to the gravity sewer system. There are ten cabins at the lodge that are rented out, each with a capacity of four people. Parks Branch indicated the occupancy of the cabins is about 80% in the peak of the summer and about 50% during the winter off-season.

It is expected that another ten cabins would be added at the lodge in the future once water and wastewater infrastructure improvements have been made in the community. This will be included in the year 20 design.

2.6.6 Paint Lake Lodge - Restaurant

The Paint Lake Lodge has a restaurant that is serviced with water from the Paint Lake water treatment plant and has sewage collection from the gravity sewer system. The restaurant has a dining capacity of fifty seats. Assuming the restaurant turns over every seat three times per day during the peak season (breakfast, lunch, and dinner), there would be 150 patrons per day at the restaurant. There is not expected to be any growth in the restaurant population in the next 20 years.

2.6.7 Wildfire Base

The Manitoba Wildfire Services Base is serviced by water from the Paint Lake WTP and has sewage collected by the gravity sewer system. The base is open from beginning of May to the end of September with the peak of the season occurring in July and August.

Parks Branch has indicated there are fifty people who live full-time at the base during wildfire season and there are thirty Parks staff which use the base during the daytime in the summer. Parks Branch has plans to expand the wildfire base in the future and expect an additional fifteen staff. It is assumed that the daytime Parks staff would be at the building for an average of 8 hours per day, therefore the equivalent population would be assumed to be 1/3 of the total day

user population (10 people).

2.6.8 Population Summary

The Design Year 20 population contributing to the Paint Lake lagoon is estimated to be 1,524 people. The table below summarizes the current and projected service populations.

Table B: Summary of Service Population

Contributing Population	Current Population	Year 20 Population
Cottages – Permanent Occupancy	369	519
Cottages – Seasonal Occupancy	240	240
Campground – Campsites (peak 80%)	461	461
Campground – Yurts (peak 80%)	15	15
Paint Lake Lodge – Cabins (peak 80%)	32	64
Paint Lake Lodge – Restaurant	150	150
Wildfire Base (daytime users, 1/3 population)	10	10
Wildfire Base (residents)	50	65
Total	**1,327**	**1,524**

2.7 Wastewater Production

The Paint Lake campground, lodge and wildfire base utilizes a gravity sewer collection system, with four lift stations that pump into the lagoon primary cell. The lagoon also receives truck haul wastewater from sewage holding tanks in the private cottage development, yurts, beach washrooms and campground office.

2.7.1 Organic Loading

The organic loading calculation is based upon the organics in typical residential wastewater and septage. A typical value of 0.076 kg Biochemical Oxygen Demand (BOD)/person/day is utilized for residents with gravity sewer systems or those utilizing holding tanks, and that are fully serviced. This would apply to the permanent and seasonal cottages, and the wildfire base. The campground, yurts, restaurant and lodge cabins utilize reduced BOD loadings as there are less amenities and reduced water usage.

Cottages – Permanent Occupancy

The local septic hauling service indicated that the holding tanks at the permanently occupied cabins are pumped out every 2 – 4 weeks, with an average of every 3 weeks throughout the year.

Table C: Permanent Occupancy Cottage Organic Loadings

Project Year	Number of Cottages – Permanent Occupancy	Average Residents Per Cottage	Average Days Between Pump Out	Daily Per Capita BOD Production (kg)	Peak Number of Pump Outs Per Day	Peak Day BOD Load From Holding Tanks (kg)
0	123	3	21	0.076	9	43.1
20	173	3	21	0.076	12	57.5

The table above summarizes the organic load to the lagoon from the pump outs of the holding tanks of permanently occupied cottages. The current peak organic load is 43.1 kg BOD_5/day and the projected peak organic load after an increase of fifty cottages is 57.5 kg BOD_5/day.

Cottages – Seasonal Occupancy

The typical organic loading rate of 0.076 kg BOD_5/person/day was also used for the seasonal cottage populations, as these cottages are expected to have all the amenities of a permanently occupied cottage (dishwasher, laundry machine, etc.). The local septic hauling service indicated the holding tanks at the seasonal cottages have sewage hauled every 3 to 4 weeks from May to September; an average of once every twenty-five days during this period was assumed.

Table D: Seasonal Occupancy Cottage Organic Loadings

Number of Cottages	Average Residents Per Cottage	Average Days Between Pump Out	Daily Per Capita BOD Production (kg)	Peak Number of Pump Outs Per Day	Peak Day BOD Load From Holding Tanks (kg)
80	3	25	0.076	5	28.5

The current and future peak organic load from the holding tanks at seasonal cottages is 28.5 kg BOD_5/day.

Wildfire Base

The typical organic loading rate of 0.076 kg BOD_5/person/day was used for the wildfire base as staff will be living there full time. The daytime Parks staff organic loading is assumed to be 1/3 of the total.

Table E: Wildfire Base Organic Loadings

Project Year	Number of Residents	Number of Daytime Users	Daily Per Capita BOD Production (kg)	Factor For Daytime Users	Peak Day BOD Load (kg)
0	50	30	0.076	1/3	4.6
20	65	30	0.076	1/3	5.7

The current organic load from the wildfire base is estimated to be 4.6 kg BOD_5/day and the

projected organic load after an increase of fifteen residence staff is estimated to be 5.7 kg BOD_5/day.

Campground - Campsites

The daily per capita BOD_5 production from campsites is expected to be less than a cottage as the only loadings will come from the toilet, washroom sink and showers. The 2002 US EPA *Onsite Wastewater Treatment Systems Manual* (EPA Manual) Table 3-8 indicates that for typical residential wastewater the BOD production occurs from the following sources: 28% garbage disposal, 26% toilet and 45% bathing, sinks and appliances. For campground populations there will be no loadings from garbage disposal and the 'bathing, sinks and appliances' loadings is expected to be approximately 1/3 of typical loadings as there will be no laundry load, dishwashers, kitchen sink load etc. Therefore, the organic loadings are expected to be 41% of typical (26% toilet and 45%/3 = 15% 'bathing, sinks and appliances'). The organic loading rate of 0.031 kg BOD_5/person/day (0.076 kg BOD_5/person/day x 41%) was used for the campground population.

Table F: Campsite Organic Loadings

Number of Campsites	Average People per Campsite	Daily Per Capita BOD Production (kg)	Peak Occupancy	Peak Day BOD Load (kg)
192	3	0.031	80%	14.3

The current and future peak organic load from the campsites at the campground are estimated to be 14.3 kg BOD_5/day.

Campground Yurts

The organic loading rate of 0.031 kg BOD_5/person/day (0.076 kg BOD_5/person/day x 41%) was used for the yurt population to match the campground loading rate.

Table G: Yurt Organic Loadings

Number of Yurts	Average People per Yurt	Average Days Between Pump Out	Daily Per Capita BOD Production (kg)	Peak Occupancy	Peak Day BOD Load From Holding Tank (kg)
6	3	7	0.031	80%	3.1

The current and future peak organic load from the yurts at the campground is 3.1 kg BOD_5/day.

Paint Lake Lodge - Cabins

The daily per capita BOD_5 production from the rental cabins is expected to be less than the

seasonal and permanent cottages as there is likely less laundry use, however there are expected to be loadings from food preparation. For calculations, the organic loading rate will use 2/3 of the load from 'bathing, sinks and appliances and the full load from other sources. Therefore, the organic loading is expected to be 85% of typical or 0.065 kg BOD_5/person/day (0.076 kg BOD_5/person/day x 85%).

Table H: Paint Lake Lodge Cabins Organic Loadings

Project Year	Number of Cabins	Average Guests Per Cabin	Daily Per Capita BOD Production (kg)	Peak Occupancy	Peak Day BOD Load (kg)
0	10	4	0.065	80%	2.1
20	20	4	0.065	80%	4.2

The current organic load from the cabins at Paint Lake Lodge is estimated to be 2.1 kg BOD_5/day and the projected organic load after an increase of 10 cabins is estimated to be 4.2 kg BOD_5/day.

Paint Lake Lodge - Restaurant

The EPA provides an average wastewater generation rate of 11 L per meal served at a restaurant. The same document also shows that the strength of wastewater from restaurants is approximately 6.5 times higher than the BOD_5 levels in residential wastewater. As per the EPA document typical residential wastewater BOD_5 concentration is 155 mg/L, meaning that the estimated BOD_5 concentration in the restaurant wastewater will be 1,008 mg/L (0.001 kg/L). This results in an organic load of 0.011 kg BOD_5 per restaurant patron.

Table I: Paint Lake Lodge Restaurant Organic Loadings

Dining Room Seats	Average Turnovers Per Seat Per Day	BOD_5 Per Patron (kg)	Peak Day BOD Load (kg)
50	3	0.011	1.7

The current and future peak daily organic load from the Pant Lake Lodge restaurant is estimated to be 1.7 kg BOD_5/day.

Organic Loading Summary

The following table summarizes the organic loads from all contributing populations to the PLPP lagoon.

Table J: Lagoon Organic Loading Summary

Organic Loading Source	Peak Daily Organic Load for Year 0 Population (kg BOD_5/day)	Peak Daily Organic Load for Year 20 Population (kg BOD_5/day)
Cottages – Permanent Occupancy	43.1	57.5
Cottages – Seasonal Occupancy	28.5	28.5
Campground – Campsites	14.3	14.3
Campground – Yurts	3.1	3.1
Paint Lake Lodge – Cabins	2.1	4.2
Paint Lake Lodge – Restaurant	1.7	1.7
Wildfire Base	4.6	5.7
Total	**97.4**	**115.0**

The current daily peak organic load to the Paint Lake Lagoon is 97.4 kg BOD_5/day. With an increase of fifty cottages and ten cabins at the lodge the projected daily peak organic load is 115.0 kg BOD_5/day.

2.7.2 Hydraulic Loading

The current holding period as indicated by the lagoon's license is November 1 to May 15. When a new license is issued the holding period will become November 1 to June 15 based on current provincial regulations. Therefore, the hydraulic storage requirements for a facultative lagoon are based on a winter storage period from November 1 to June 15 each year. The two sources of wastewater for the lagoon are from facilities connected to the gravity sewer system and from truck hauled wastewater from holding tanks.

2.7.2.1 Truck Hauled Wastewater Collection

Truck hauled wastewater volumes were based on discussions with Parks Branch and the local septic hauler. Parks Branch has a septic truck that hauls sewage from three holding tanks used for the yurts, the beach washrooms, and the campground office. The local septic service hauls all of the sewage from the holding tanks for the cottages, including seasonal and permanently occupied cottages. According to Parks Branch there are also approximately forty loads hauled to the lagoon per year from other private septic haulers.

The local septic hauler indicated the holding tanks for the cottages vary between 4,546 L to 9,092 L (1,000 to 2,000 gal), an average holding tank volume of 6,819 L (1,500 gal) is used for determining the hydraulic loadings on the lagoon.

Cottages – Permanent Occupancy

The wastewater from the permanently occupied cottages is hauled throughout the

year, with each tank pumped out on average every three weeks. Using three people per cottage results in a per capita wastewater production of 108 L/person/day. The EPA document provides a typical water use range of 30 – 190 L/person/day with an average of 150 L/person/day. The calculated wastewater production of 108 L/person/day is within the reported range, however lower than average. This is reasonable with each cottage serviced by a holding tank as there is incentive to reduce water consumption.

During the 230-day storage period this would result in each tank being pumped out on average eleven times.

With 123 current cottages permanently occupied, an average tank size of 6,819 L and eleven pump outs in the winter storage period the current hydraulic load from the cottages is 9,226 m^3. During the summer discharge period each tank would be pumped out approximately seven times, resulting in 5,871 m^3 of wastewater during the 135-day period.

The future 173 permanently occupied cottages, with the same tank size and pump out frequency, would result in a hydraulic load of 12,977 m^3 during the winter storage period and 8,258 m^3 during the summer discharge period.

Cottages – Seasonal Occupancy

According to Parks, the seasonal cottages are used from May to September, meaning there are six weeks during the storage period that will have wastewater hauled from the seasonal cottages. During the summer discharge period from June 16 to October 31, the seasonal cottages are expected to be in use for fifteen weeks.

Based on discussions with the local septic hauler, the seasonal cottage holding tanks are pumped out on average every three and a half weeks between May and September, which results in an average wastewater production of 91 L/person/day. This is reasonable as most seasonal cottages would not be occupied every day during the summer.

The eighty seasonal cottages are each pumped out approximately two times before June 15 during the winter storage period and five times during the summer discharge period. An average holding tank size of 6,819 L was used for calculations. This results in a hydraulic load of 1,091 m^3 during the storage period and 2,728 m^3 during the summer discharge period.

There is no expected growth to this population so the future load will be the same as the current hydraulic load.

Parks Branch Holding Tanks

The Parks Branch has three holding tanks which are pumped out using their own septic truck from the opening of the campground at the end of May through to mid September. The wastewater from the daily park users would typically be captured by the washroom holding tank at the beach. Each of the tanks is 2,273 L (500 gal) and all are pumped out once per week.

Assuming four weeks of tank pump outs before the end of the storage period on June 15, there would be 27 m^3 of wastewater hauled from these tanks contributing to the hydraulic winter storage requirements of the lagoon. From June 16 to the second week of September, there are thirteen weeks in which the tanks would be pumped out during the summer discharge period, which is a hydraulic load of 89 m^3.

There is no expected growth to the campground so the future load will be the same as the current hydraulic load.

2.7.2.2 Gravity Sewer Wastewater Collection

The Paint Lake Lodge (cabins and restaurant), the Wildfire Base, and the campground washrooms and shower building are serviced by a gravity sewer system with four lift stations. All of these users are provided treated water by the Paint Lake water treatment plant. Monthly water treatment plant flow data provided by Parks was reviewed from 2019 to 2021 to determine the monthly water usage.

The winter storage period for the lagoon is from November 1 to June 15, so the average water usage from November to May and half of the average water usage in June will be used to determine an average water usage from the piped service areas of the campground. The total water usage in the storage period is 4,484 m^3 (19.5 m^3/day). During the summer period from June 16 to October 31, when discharging of the lagoon is allowed, the total water usage is 4,145 m^3 (30.7 m^3/day).

Parks Branch indicated that none of the lift stations are equipped with flow meters or pump hour meters, as the control panels were installed in the late 1970s. Therefore, there is currently not a way to directly measure the wastewater sent to the lagoon via the gravity sewer system. The wastewater production was estimated based on the water usage including an assumed infiltration rate.

Parks indicated there is currently a project underway to perform upgrades to the main lift station, with works expected to be completed in the fall of 2022. The project includes the supply of a new control panel which is expected to record pumping hours.

2.7.2.3 Infiltration

Generally, the wastewater generation rate is higher than the water usage as it

includes the water used by residents and water that has infiltrated into the gravity sewer system. Potential infiltration sources include manholes, mainlines, and weeping tiles around building foundations being connected to the sewer system. Based on past experience with communities in Manitoba the infiltration into a gravity sewer system can range from 10% up to 100% or more of the water consumption depending on the age and condition of the system, type of pipe, typical groundwater levels, and condition of manholes. According to Parks Branch there is likely some infiltration into the gravity sewer collection, however the actual volume was unknown. The infiltration volume was estimated based on changes in liquid levels in the lagoon cell and precipitation over the area. The total infiltration over the winter storage period is estimated to be 10,788 m^3 (46.9 m^3/day).

2.7.2.4 Current Gravity Sewer Hydraulic Loads

The current wastewater production from the gravity sewer system during the 230-day winter storage period is 15,272 m^3 (66.4 m^3/day). The current wastewater production from the gravity sewer system during the 135-day summer discharge period is 10,477 m^3 (77.6 m^3/day).

2.7.2.5 Future Piped Hydraulic Loads

The population growth serviced by the gravity sewer collection system during the next 20 years will be at the lodge rental cabins and the new staff at the wildfire base. It is assumed there will be an additional ten cabins built in the future and the average occupancy of the cabins is assumed to be 80% during the summer period and 50% during the winter off-season.

The EPA document provides typical wastewater flow rates from various commercial facilities. The document lists an average wastewater generation of 150 L/person/day for guests at a resort cabin. The hydraulic loading rate for the wildfire base was estimated to be the same.

The additional hydraulic loading from the rental cabins is expected to be 4.8 m^3/day during the summer (mid-May to mid-September) and 3.0 m^3/day during the winter. The additional hydraulic loading from the expanded wildfire base is expected to be 2.3 m^3/day from May to September.

Over the 230-day winter storage period the total additional hydraulic load is expected to be 785 m^3 (30 days x 4.8 m^3/day + 200 days x 3.0 m^3/day + 18 days x 2.3 m^3/day). During the 135-day summer discharge period the total additional hydraulic load is expected to be 882 m^3 (92 days x 4.8 m^3/day + 43 days x 3.0 m^3/day + 135 x 2.3 m^3/day).

The infiltration rate is not expected to change based on the additional cabins.

The projected year 20 hydraulic load over the 230-day winter storage period from the

gravity sewer system is estimated to be 16,057 m^3 (69.8 m^3/day). The projected year 20 hydraulic load during the 135-day summer discharge period from the gravity sewer system is estimated to be 11,359 m^3 (84.1 m^3/day).

2.7.2.6 Total Hydraulic Loading Summary

The following table summarizes the current and projected year 20 hydraulic loads for the Paint Lake lagoon during the 230-day winter storage period and during the 135-day summer discharge period:

Table K: Lagoon Hydraulic Loading Summary

Hydraulic Loading Source	Storage Period		Discharge Period	
	Load for Year 0 Population (m^3)	Load for Year 20 Population (m^3)	Load for Year 0 Population (m^3)	Load for Year 20 Population (m^3)
Permanently Occupied Cottages	9,226	12,977	5,871	8,258
Seasonal Cottages	1,091	1,091	2,728	2,728
Parks Holding Tanks	27	27	89	89
Gravity Sewer	15,272	16,057	10,477	11,359
Total	**25,616**	**30,152**	**19,165**	**22,434**

2.8 Lagoon Sizing Requirements and Existing Capacity

The organic and hydraulic storage capacities of the existing Paint Lake lagoon were determined from information provided by Parks Branch, aerial mapping and measurements made during the onsite investigations. The requirements for lagoon loading, sizing and design were based on the Manitoba *Information Bulletin – Design Objectives for Wastewater Treatment Lagoons* (September 2014).

2.8.1 Primary Cell

The minimum sizing of the primary cell is based on the required surface area at a height of 0.75 m from the cell floor and the standard organic treatment rate for a facultative lagoon of 56 kg BOD_5/ha/day. The minimum required surface area at 0.75 m, to treat the current peak organic loading of 97.4 kg BOD_5/day would be 17,392 m^2, and the projected peak organic loading of 115.0 kg BOD_5/day in design year 20 would be 20,536 m^2.

The existing Paint Lake lagoon primary cell currently has a surface area of approximately 4,393 m^2 at a depth of 0.75 m, resulting in a total organic capacity of 24.6 kg BOD_5/day. The existing lagoon primary cell does not have sufficient organic capacity for the current and projected year 20 organic loading rate, and therefore expansion of the primary cell is required.

2.8.2 Storage Cell

The total hydraulic storage capacity of the lagoon is generated from the volume of the storage cell(s) between the discharge pipe invert (0.3 m) and the maximum liquid operating level (1.5 m), along with the "top half" of the primary cell (0.75 m depth to 1.5 m depth). The total hydraulic storage capacity would need to be sufficient for 230 days of storage from the projected year 20 hydraulic loadings.

Based on the estimations of the lagoon sizing and capacity, the existing lagoon cells have a combined hydraulic storage capacity of 14,773 m^3.

Based on the estimated hydraulic loading from the community, the lagoon requires a current storage capacity of 25,616 m^3 over the 230-day storage period, and a projected storage capacity of 30,152 m^3 over the 230-day storage period in design year 20. Therefore, the existing lagoon does not have sufficient hydraulic storage for the current or projected hydraulic loading from the service population and will require hydraulic expansion. The Parks Branch indicated that the lagoon has recently required emergency discharges, due to high precipitation levels in the winter and spring.

2.8.3 Wastewater Production and Lagoon Capacity Summary

The following table is a summary of the existing and estimated lagoon organic and hydraulic loading, along with the existing lagoon capacity.

Table L: Summary of Organic and Hydraulic Loading and Lagoon Capacity

Lagoon Loading	Existing Lagoon Capacity	Current Capacity Needed	Capacity Needed in Design Year 20 (230 days)
Organic	4,393 m^2	17,392 m^2	20,536 m^2
Hydraulic	14,773 m^3	25,616 m^3	30,152 m^3

2.9 Sludge Assessment

Assiniboine Injections Ltd. conducted a sludge assessment on June 23, 2022 to determine the volume and thickness of sludge accumulation in the lagoon cells and review the chemical properties of the sludge (see report attached in Appendix B).

The sludge assessment of the primary cell indicated a total sludge accumulation of approximately 3,150 m^3, with a sludge thickness ranging from 0.15 m to 0.91 m. The thickest accumulation of sludge was near the truck dump spillway and in the southwest corner of the cell, while the average sludge thickness throughout the cell was 0.70 m. The sludge accumulation in a primary cell becomes a concern if the thickness of sludge exceeds 0.75 m, as this is the depth at which the hydraulic capacity is measured. Therefore, the sludge depth in the primary cell is impacting the overall hydraulic capacity in some portions of the cell.

The sludge assessment of Storage Cell 1 indicated a total sludge accumulation of approximately 3,699 m^3, with a sludge thickness ranging from 0.20 m to 0.76 m. The thickest accumulation of sludge was in the southeast and northeast corners, while the average sludge thickness throughout the cell was 0.39 m. The sludge assessment of Storage Cell 2 indicated a total sludge accumulation of approximately 732 m^3, with a sludge thickness ranging from 0.15 m to 0.46 m. The thickest accumulation of sludge was at the inner dike walls, while the average sludge thickness throughout the cell was 0.33 m. The sludge accumulation in storage cells becomes a concern if the thickness of sludge exceeds 0.3 m, as this is the typical discharge pipe invert height from the cell floor, and is the height of liquid that is typically left in the cell after discharge. The sludge accumulation in the storage cells is compromising the overall hydraulic capacity of the lagoon.

Samples of the sludge were taken from the lagoon cells and sent to ALS Environmental laboratory for analysis. See Appendix B for the sludge analysis report completed by ALS Environmental.

2.9.1 Sludge Removal

Several options for removal of the sludge were considered:

- Sludge dewatering and land application of biosolids
- Sludge dewatering and landfill disposal of biosolids
- Excavation or pumping of sludge into Storage Cell 2 after decommissioning
- Excavation or pumping of sludge into the newly expanded primary cell.

The most feasible option selected was to transfer the sludge into the new primary cell after commissioning of the cell. The expanded portion of the primary cell would be constructed at a slightly deeper depth than required to accommodate the sludge and other excavation material from the existing primary cell without impacting the cell's capacity. The sludge from the existing primary cell would be spread evenly over the clay liner base of the expansion cell while a liquid depth of 1.5 m would be maintained as the design objective. The capacity of the primary cell expansion would not be reduced from the sludge transfer. Sludge would not be removed from Storage Cell 1, however the design of the new primary cell expansion would offset the loss of hydraulic capacity from the sludge in the existing Storage Cell 1.

The expanded area of the Primary Cell is approximately 20,700 m^2. The expected volume of sludge from the existing Primary Cell and Secondary Cell 2 is 3,882 m^3. If the sludge was spread evenly over the expanded Primary Cell, the depth would be 0.19 m. The expanded area of the Primary Cell is proposed to be constructed 0.3 m deeper than typical to account for the sludge without impacting the storage volume of the cell accounting for a safety factor in case additional sludge is encountered.

2.10 Topography and Geotechnical Investigation

2.10.1 Site Conditions and Topography

Based on site observations the land surrounding the existing lagoon was forested, with the Parks Branch maintenance yard adjacent to the southeast and equipment storage adjacent to

the northwest. The proposed expansion area was relatively dry at the time of the investigation. Based on the topographic survey data, the existing primary cell was constructed at an elevation approximately 0.3 m to 0.9 m higher than the storage cells.

In the area of proposed expansion to the northwest of the existing cells, the existing ground elevations ranged from 203.70 m on the east side of the site to 197.35 m on the west side of the site over a distance of approximately 275 m, which results in an average slope of 2.3% from east to west. The elevations were generally the highest in the southeast of the area near the primary cell and the lowest in the southwest, following a general trend of decreasing elevation from east to west. The Parks Branch indicated that overland flooding has not been an issue in the area of the lagoon in the past and is not expected to be a concern. See Plan 1 in the geotechnical report attached in Appendix B for contours of the lagoon expansion area.

2.10.2 Geotechnical Information

2.10.2.1 Geotechnical Investigation

An onsite investigation of geotechnical conditions was conducted by JRCC on March 31, 2022. A drill rig was used for the test holes under the direct supervision of JRCC personnel. During the site investigation, one test hole was drilled in the southwest corner of Storage Cell 1 at an area of concern, and six test holes were drilled in the forested land northwest of the lagoon cells, to a maximum depth of 6.0 m. A detailed geotechnical report of the investigation and results is included in Appendix B.

Existing Lagoon Dike

The test hole in the lagoon dike (TH1) consisted of high plastic compacted clay from the surface down to the bottom of the test hole.

Proposed Expansion Area

Based on the soils observed in the test holes, the subsurface soil profile was fairly consistent across the expansion area to the northwest. The general soil profile consisted of surficial peat, followed by high plastic clay to bottom of the test holes. The general soil profile is summarized in the following table.

Table M: Proposed Expansion Area Soil Profile Summary

Primary Soil Type	Average Depth Range of Soil Layer	Secondary Soil Characteristics
Peat	0 m – 0.2 m	Silt
Clay (high plastic)	0.2 m – 6.0 m	Silt

Groundwater infiltration was not observed from the surface in the test holes, but the wetter conditions in the soil were observed at a depth of approximately 3.0 m below the surface. Bedrock or refusal was not encountered in any of the test holes.

Laboratory Analysis

Representative soil samples from the existing lagoon dike and proposed lagoon expansion area were submitted to Wood Environment and Infrastructure Solutions Inc. for testing and analysis. The following is a summary of the testing results:

Table N: Laboratory Analysis Summary

Test Hole	Depth of Sample (m)	Liquid Limit	Plastic Limit	Plasticity Index	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
TH1	1.5 – 3.0	55	20	35	0	1	17	82
TH4	0.2 – 3.2	59	19	40	0	0	14	85
TH4	3.2 – 6.0	33	16	17	0	1	50	49
TH6	0.2 – 4.7	57	21	36	0	0	41	59

A Shelby tube sample was taken from the layer of clay till at TH4 1.5 m – 1.9 m which obtained a hydraulic conductivity value of 1.09×10^{-8} cm/sec. A Shelby tube sample from the layer of clay till at TH4 3.4 m – 3.8 m obtained a hydraulic conductivity value of 5.90×10^{-8} cm/sec.

Typically soils with the following characteristics would provide a liner with a hydraulic conductivity of 1×10^{-7} cm/sec or less:

- Liquid limit of 30% or greater
- Plastic index of 10% or greater
- 30% or more passing a number 200 mesh sieve
- 20% or more of clay particles.

All clay material samples tested met the characteristics described above, and the in-situ Shelby tube samples from the same layers of material also met the provincial hydraulic conductivity requirement. It is therefore likely that the clay material throughout the profile would meet provincial requirements for hydraulic conductivity (1×10^{-7} cm/sec or less) in either an undisturbed or reworked state.

Therefore, it would be recommended to utilize these clay soils in an undisturbed or reworked state when constructing a lagoon liner. Other considerations in the method of liner construction would be the presence of unsuitable materials (sand, gravel, silt) observed within the construction depth.

2.11 Lagoon Liner

2.11.1 Design Guidelines

Provincial guidelines require that a standard wastewater lagoon soil liner be a minimum of 1.0 m in thickness and have a hydraulic conductivity (i.e., the potential rate of fluid movement through the soil) of 1 x 10^{-7} cm/sec or less. This low permeability rate is to protect the underlying groundwater from lagoon effluent seepage.

2.11.2 Lagoon Expansion Liner Design

Based on the results of the onsite investigation and laboratory analysis, it is proposed to construct the floor liner of the expansion cell to the northwest of the existing cells with in-situ (undisturbed) soils, at the desired excavation depth. A vertical cut-off wall of re-compacted soils is proposed for the perimeter liner, which would tie into the in-situ cell floor liner. Lagoon dike cross-sections are shown on Plan 4 in Appendix C.

2.11.3 Utilization of Onsite Soils

The topsoil material would be stripped from the cell construction area and stockpiled for use as top dressing on the top and outer slopes of the new lagoon cell. The high plastic clay soils below the topsoil would be suitable for use in construction of a soil liner (vertical cut-off wall and horizontal floor). Any unsuitable material (sand or stone seams) discovered during construction would need to be removed from the lagoon liner to prevent the possibility of preferential flow paths through the liner.

2.12 Review of Regulatory Requirements

The provincial *Design Objectives for Wastewater Treatment Lagoons* (September 2014) was used as a guideline in the layout and design of the lagoon expansion development. The provincial siting requirements are described in Section 2.5.2 above.

2.12.1 Effluent Quality Requirements

Any new or expanding wastewater treatment lagoons are required to meet the Manitoba *Water Quality Standards, Objectives and Guidelines - Tier 1 Water Quality Standards* at a minimum, along with the Federal *Wastewater Systems Effluent Regulations*, for discharged effluent. The effluent requirements for the Paint Lake wastewater treatment lagoon, at a minimum, would include:

- Fecal coliforms of 200/100 ml or less, or E. coli of 200/100 ml or less
- BOD of 25 mg/L or less
- CBOD of 25 mg/L or less
- TSS of 25 mg/L or less
- Total residual chlorine of 0.02 mg/L or less
- Un-ionized ammonia (as N) of 1.25 mg/L or less, at 15ºC

- 1 mg/L Total Phosphorus or demonstrated nutrient reduction strategy.

The lagoon effluent will be tested for the above parameters prior to seasonal discharge and the results of the analysis will be provided to Manitoba Compliance and Enforcement Branch for approval.

2.12.2 Nutrient Management Plan

The Manitoba *Water Quality Standards, Objectives, and Guidelines*, 2011, outline the nutrient reduction requirements for effluent in all new, expanding or modified wastewater treatment facilities. The guidelines include province wide standards for biological reduction, suspended solids reduction, phosphorus reduction and where site-specific conditions warrant, nitrogen reduction. The Federal *Wastewater Systems Effluent Regulations*, 2012, outline the limits on un-ionized ammonia concentration in the effluent.

Typically, an un-ionized ammonia concentration of 1.25 mg/L can be met by a facultative lagoon cell with no specific treatment for ammonia, however there is the possibility that in mid-summer, high temperatures combined with algae blooms can cause the pH to rise, which could result in an un-ionized ammonia above 1.25 mg/L. If the un-ionized ammonia concentration is above the limits, the most practical solution would be to wait until the temperature and pH drop in the fall, before discharging.

Under the nutrient reduction guidelines released in the Manitoba Water Quality Standards, Objectives, and Guidelines (2011), small wastewater treatment facilities which serve less than 2,000 equivalent people have the option of implementing a nutrient reduction strategy instead of the 1.0 mg/L phosphorus limit prior to discharge. Nutrient reduction strategies include, but are not limited to, effluent irrigation, trickle discharge, or constructed wetlands. Paint Lake has a total peak organic loading of 115 kg BOD_5/day which is an equivalent full-time population of 1,513 people (115 kg BOD_5/day / 0.076 kg BOD_5/person/day) therefore; it could qualify for a nutrient reduction strategy.

The lagoon currently discharges to a natural wetland through a discharge ditch that is approximately 1 km long, which is expected to provide nutrient reduction via natural uptake by vegetation along the discharge route and within the wetland. Utilizing the natural wetlands is expected to have a positive environmental impact compared to utilizing chemicals as carbon emissions would be reduced without the requirement of transporting chemicals to the site and there would be less sludge generation in the lagoon. Utilizing the natural wetland would also lead to less safety risks to operators as they would not be required to handle chemical or utilize a boat in the lagoon cells.

It is requested to enforce the 1.0 mg/L total phosphorus limit at the outlet of the natural wetlands, rather than the outlet of Secondary Cell. If in consecutive discharge events, the phosphorus limits could not be met at the outlet of the wetlands, the phosphorus limit could revert to the Secondary Cell outlet until the phosphorus concentration in the natural wetlands is reduced.

As part of the construction works, a path will be cleared to the outlet of the natural wetlands to allow Parks staff to sample the wetland effluent.

If the phosphorus limit were to revert to the Secondary Cell, surface spreading of alum would be required.

2.13 Expanded Lagoon Design Considerations

The expanded lagoon design will consist of:

- Constructing a new primary cell expansion to the northwest of the existing lagoon cells
- Lowering existing primary cell floor to match expansion cell
- Decommissioning of Storage Cell 2

The expanded lagoon would have the following design characteristics:

- A floor liner of in situ soils
- A vertical liner of re-worked and compacted soils in the centre of the dikes
- Interior and exterior slopes of 4H:1V
- A total cell depth of 2.8 m including a maximum operating depth of 1.5 m, a 1.0 m freeboard and 0.3 m for sludge storage
- A minimum liquid depth of 0.3 m above the sludge layer after discharge (discharge pipe invert 2.2 m below top of dike)
- Top of dike elevation which would match the top of dike elevation in the existing Storage Cell 1. Some areas of the dike would be constructed at a higher elevation to ensure the top of dike is higher than the surrounding ground elevation to prevent surface water from coming into the lagoon cells. The transitions between top of dike elevations should be at a 10:1 slope to allow vehicle traffic on the top of dike.
- A perimeter ditch around the toe of the expansion cell dikes
- A new discharge pipe on the southeast of Storage Cell 1 and connecting to existing drainage ditch
- A new intercell pipe between the expanded primary cell and Storage Cell 1
- Upgrades to the concrete spillway in the existing primary cell
- A barbed wire fence around the perimeter of the expanded primary cell dikes and repair of existing perimeter fence
- Decommissioning of existing discharge pipe and intercell pipes by capping
- Decommissioning of existing Storage Cell 2 in place by discharging, sludge removal and levelling of dikes and well as placement of granular material to utilize the area as equipment storage
- Valve markers at the new discharge and intercell pipe locations.

The existing forcemain, lagoon approach and spillway will continue to be utilized. A new 300 m long 150mm discharge pipe on the south side of Storage Cell 1 will be installed, and will connect to the existing discharge ditch. A new 75 m long 200 mm intercell pipe will be installed between Storage Cell 1 and the expanded primary cell.

2.13.1 Summary of Lagoon Sizing Design Criteria

The expanded lagoon will be sized to handle the projected organic and hydraulic loadings from the service area, to design Year 20. A summary of design parameters used in sizing the proposed lagoon expansion includes:

- A minimum 20-year design period
- A total service population of 1,524 people
- A hydraulic storage period of 230 days
- A total peak daily organic loading rate of 115.0 kg BOD_5/day in design year 20
- A total organic capacity of 158.3 kg BOD_5/day in the expanded primary cell based on an area at 0.75 m height of 28,263 m^2 (primary cell to be constructed larger than required to allow for sufficient hydraulic storage so Secondary Cell 1 does not require expansion)
- A total hydraulic storage requirement of 30,152 m^3 over the 230-day storage period in design Year 20
- A total hydraulic capacity of the expanded lagoon of 30,350 m^3
  - 22,087 m^3 of hydraulic capacity from the expanded Primary Cell from 0.75 m liquid depth to 1.5 m
  - 8,263 m^3 from Secondary Cell 1 from a liquid depth of 0.4 m (top of sludge) to a liquid depth of 1.5 m
- A discharge pipe invert of 0.3 m above the floor of the Storage Cell 1
- Inner and outer dike slopes of 4H:1V in the proposed primary cell expansion
- Depth of 2.8 m (0.3 m sludge storage, 1.5 m liquid operating depth, 1.0 m freeboard) in the proposed expanded primary cell.

In addition, the existing primary cell will be lowered by 0.8 m to match the proposed cell floor elevation in the new primary cell.

2.14 Lagoon Expansion Construction Details

The area proposed for the lagoon expansion cell would be cleared of surface vegetation, and would have the topsoil layer removed and stockpiled. The subsurface soils would be excavated and the dikes constructed with excavated and compacted soil from the cell expansion area to the northwest. For the dike construction, the excavated material will be compacted with a sheepsfoot roller on maximum 150 mm compacted lifts. A limited range of moisture content will be permitted during construction. The soil material shall not be so wet or so dry that compaction equipment cannot compact the fill into a homogeneous mass. Material too wet shall be dried or wasted and material too dry shall be wetted. Any

unsuitable soils encountered in the excavation could be used for constructing the outer and inner slopes, however should not be used in the construction of the vertical cut-off wall or liner.

The top of the lagoon dikes will be constructed with a width of 3.0 m to allow vehicle access. Topsoil removed from the expansion area will be used as cover material on the dike tops and slopes after cell construction is complete. The top of dikes and outside slopes would be seeded with grass upon completion of construction to reduce soil erosion. Rip rap stone would be placed at the intake and outfall of the discharge and intercell piping, to minimize erosion. Rip rap is planned to be placed 0.5 above and below the high water level of the Primary Cell and Secondary Cell 1 to reduce erosion, if budgets permit.

A new intercell pipe would be installed between the existing Storage Cell 1 and the expanded primary cell after the lagoon liquid levels have been lowered and a coffer dam has been temporarily constructed in the storage cell around the pipe area. A discharge pipe would be installed in the southeast dike of the existing storage cell also when the liquid levels have been lowered and a coffer dam has been constructed around the pipe area. The new discharge pipe to the southeast would connect with the existing lagoon drainage route, which would continue to be utilized.

A perimeter ditch would be constructed around the outside toe of the proposed primary cell expansion and would be graded towards the existing discharge ditching. The outer slope and perimeter drainage ditching would prevent surface drainage from entering into the lagoon and would prevent the ponding of surface drainage water around the perimeter of the lagoon.

A 1.2 m high barbed wire fence would be installed around the outside toe of the proposed primary cell expansion and would connect to the existing perimeter fencing to discourage unauthorized entry into the lagoon area by people and large animals. This fence would tie into the new lockable gates at the two entrances to the lagoon site. Additional fencing would be installed around portions of the lagoon cells where the fence is missing or has been damaged.

2.15 Decommissioning

The existing Storage Cell 2 would be decommissioned by discharging the liquid from the cell, removing the sludge, capping the intercell and discharge pipes and levelling of the dikes to allow positive surface drainage. Parks intends to place gravel on the decommissioned cell area and use the cell for equipment storage.

The Parks Branch is proposing to continue operating the existing and proposed lagoon cells over the next 20 years, as hydraulic and organic capacities allow. Lagoon decommissioning will be considered and examined by the Parks Branch after design Year 20 has passed.

Decommissioning would typically require a decommissioning plan submitted to MECP, discussing the removal of liquid and sludge, possible leveling of lagoon dikes, site grading and seeding, and discussion of future land use.

2.16 Lagoon Maintenance

Maintenance of the expanded lagoon will include:

- opening and closing the intercell valves, when required
- maintaining grass cover on dikes to a height of no more than 0.3 m in height
- removing aquatic vegetation growing on interior slopes of lagoon cells
- maintaining a program to prevent and remove burrowing animals
- monitoring liquid level of lagoon cells
- sampling lagoon effluent prior to the discharge period, in accordance with the lagoon licence requirements
- discharging effluent from the lagoon storage cells when permitted
- maintaining records of discharge events and effluent quality testing.

3.0 POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

The biophysical and socioeconomic environment as related to the development, and potential impacts of the development on the environment. Proposed environmental management practices to be employed to prevent or mitigate adverse implications from the impacts identified.

Environmental issues where they may occur, and mitigating measures where necessary, are presented in the chart on the following pages, which outline the assessment of the expected actions. Environmental features are assessed against the project actions in the chart. The environmental features include: groundwater, surface water, air quality, noise, land/soil, vegetation, wildlife, habitat, special places (cultural, traditional, historic, scientific), health and safety, socio/economic and aesthetics.

Potential ratings of "I" meaning insignificant, "SN" meaning negatively significant, and "SP" meaning positively significant were identified for the environmental issues depending on possible environmental impacts of the project actions on the environmental features. A project action with no potential environmental issues after mitigation measures are applied was considered insignificant. A project action with identified or residual environmental issues after mitigation measures are applied is considered significant. Where a project action with positive impact on the environment or socio economic aspect is identified, the environmental issue was considered positively significant and the benefits are stated.

The proponent of the development should ensure that the contractor performing the site works is made aware of the potential environmental issues by way of the construction specifications, prior to commencing with the site works, and that mitigation measures discussed below are followed during site works.

Table 0: Potential Impacts, Mitigating Measures and Residual Effects

Project Action	Environmental		Rating	Mitigating Measures
	Feature	Issue		
1 Clearing, excavation, construction of lagoon cell, ditching and fencing	Groundwater or Surface Water	Contamination from fuel storage and handling spills	I	Handling and storage of petroleum products will be conducted according to federal (*Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations*) and provincial (*Storage and Handling of Petroleum Products and Allied Products Regulation*) regulations. The construction specifications should outline to the contractor, requirements for the handling and storage of petroleum products and hazardous materials during construction and for working near water with construction equipment. Any fuel stored and handled on the construction site should be located a minimum of 100 m from a water body, reservoir and low lift station. Proper collection and disposal of waste hazardous materials, oil and lubricating products from construction equipment; • Contractor must have emergency spill clean-up materials on site, with a minimum of 25 kg of suitable commercial sorbent, 30 m^2 of 6 mil polyethylene, and an empty fuel barrel for spill collection and disposal; • Notification of project engineer and provincial environment officials in the event of any spills of petroleum products or hazardous materials. Manitoba's Spill Reporting hotline is (204) 945-4888; Fuel is to be used and stored on site in a properly installed double walled containment unit.
		Contamination from construction equipment leaks	I	The Contractor is to ensure construction equipment is inspected regularly and maintained in proper working condition to prevent leaking fluids onto the ground. Any leaks should be cleaned up in a timely manner to ensure groundwater is not impacted. A spill clean-up kit is to be located onsite.
	Soil/Surface Water	Siltation from soil erosion	I	Silt fencing would be installed in the drainage ditch to the east of the lagoon to control sediment runoff into the surface water bodies during construction and installation works. The silt fencing should remain in place until surface vegetation is re-established. Any stockpiled soil should be placed away from drainage features and be covered with tarps or erosion control blankets or re-seeded with grass. Any bare ground exposed through site disruption is to be re-vegetated as soon as possible to prevent future erosion.

Project Action	Environmental		Rating	Mitigating Measures
	Feature	Issue		
1 Construction Works cont'd	Air Quality	Dust	I	If conditions are dry and windy, causing excessive dust and blowing of soils at the time of excavation and construction, works should be temporarily shut down until conditions change or water trucks and/or approved dust control measures are utilized.
		Vehicle emissions from construction equipment	I	The contractor is to ensure construction equipment is properly maintained and that emissions from construction equipment are to comply with federal, provincial and local emissions standards, and are not a nuisance to nearby residents. Idling of vehicles will be kept at a minimum.
	Noise	Disturbance from construction equipment	I	Noise impacts are to be mitigated by operating construction equipment with engine mufflers in good working order. Construction works are to be completed during daylight hours only. Neighboring residents will receive a notice of the construction schedule.
	Land/Soil	Land Alteration/Soil Erosion	I	Any excess excavated soil material should be removed and temporarily stockpiled adjacent to the lagoon, or in the borrow pit area, or on the outside lagoon slopes. Any stockpiles are to be covered by tarps or temporary erosion control blankets or re-seeded. Soil stockpiles will not be located adjacent to the drainage ditching. Any bare soil at the site from construction disturbance should be re-seeded to prevent future soil erosion. Outside slopes of the lagoon cell will have a grade of 4H:1V and will be seeded with grass to reduce erosion.
	Soils	Encountering Contaminated Soils	I	If contaminated soils are encountered during excavation, works should be halted in the area of question and the Engineer will be notified along with any related provincial/federal authorities, as applicable. The extent of contamination will be determined, contaminated material removed and properly disposed of, in accordance with CCME *Guidance Manual for Environmental Site Characterization in Support of Environmental and Human Health Risk Assessment*, and the Manitoba *Contaminated Sites Remediation Regulation*. Once the area has been restored, works would resume.

Project Action	Environmental		Rating	Mitigating Measures
	Feature	Issue		
1 Construction Works cont'd	Health and Safety	Construction Hazards	I	To mitigate any impacts on health and safety and public hazards the following mitigating measures are to be used: • The Manitoba Workplace Health and Safety Act and Canada Occupational Health and Safety Regulations are to be applied regarding health and safety of operators, employees and the general public at the work sites • Contractor is to abide by an approved health and safety program during construction works • Ensure pits or trenches are constructed in a secure manner prior to any person entering them • Ensure all workers and visitors utilize appropriate PPE at the construction sites • Construction works are to be completed during daylight hours only • Flagmen and barricades are to be utilized where and when necessary • Any spills will be contained and cleaned up immediately, and proper authorities notified • Public access to construction sites will be restricted • Warning signs will be posted at the entrance to the site • Adhere to any federal and provincial public health orders regarding disease or viral transmission. Any injuries, incidents or fatalities are to be reported immediately to Manitoba Workplace Safety and Health, and the Workers Compensation Board of Manitoba.
	Heritage and Historic Resources	Discovery of Historic or Cultural Artifacts or Remains	I	If any archaeological, cultural or historical artifacts are discovered during construction, works are to cease immediately and any applicable provincial or federal authority would be contacted to examine the site and determine a proper course of action prior to works commencing in the area.

Project Action	Environmental		Rating	Mitigating Measures
	Feature	Issue		
1 Construction Works cont'd	Vegetation	Removal	I	The MECP Wildlife Branch were contacted and no vegetative species at risk were identified in the provincial park. The removal of trees and surface vegetation should be limited to the development area. Vegetation outside of the development area is to be protected from removal and damage by clearly marking the area of disturbance and the limits of tree clearing. Silt fencing should be utilized in drainage ditches or channels to reduce impacts of siltation to aquatic vegetation in downstream surface waters. If any vegetative species at risk are identified during the construction works, MECP should be contacted to determine a suitable course of action.
	Wildlife and Birds	Disturbance	I	The MECP Wildlife Branch were contacted regarding wildlife and bird species at risk identified in the provincial park from the provincial database (see attached email correspondence and tables in Appendix A). The expanded lagoon area will provide additional habitat for waterfowl. Construction activities will be limited to the development areas by clearly marking the limits of construction. If species or habitats are identified, construction will be avoided in these areas, if possible, or MECP will be contacted for guidance. Construction activities should be limited to daylight hours only so any species encountered can be visually identified.
	Fish Habitat/Aquatic Life	Habitat Alteration and/or Disturbance	I	Siltation in the drainage route will be reduced through the use of silt fencing during the construction works. In accordance with subsection 36(3) of the Fisheries Act, no deleterious substance is to be deposited in a body of water that contains fish species. If any deleterious substance is deposited in a body of water, the contractor will take all reasonable measures to counteract, mitigate and remedy any adverse effects.
	Economics	Local Employment and Resource Use	SP	The construction activities will likely have a positive impact on the local economy due to the use of local resources and supplies.
	Social	Heavy Equipment Traffic	I	Construction works and travel will be limited to daylight hours only. The contractor will be made aware of travelling with caution in areas where children may be present (i.e. residential zones). Local traffic should not be affected.

Project Action	Environmental		Rating	Mitigating Measures
	Feature	Issue		
	Aesthetics	Degradation of View	I	The disturbed areas in the development will be re-seeded and restored to a natural appearance. The lagoon area is difficult to see from any passing roadways and is surrounded with trees.
1 Construction Works cont'd	Aesthetics	Site Cleanliness	I	The contractor will ensure that the construction site is properly cleaned up of all rubbish, excess materials and temporary structures prior to leaving the site. Any construction materials requiring disposal will be sent to a licenced landfill site. Any hazardous waste material will be hauled to a hazardous waste facility.
2 Sludge Removal	Surface Water/Groundwater	Contamination from Lagoon Sludge Spills	I	Any sludge transferred to a new cell will be dredged and pumped directly into the new cell or excavated and placed into the new cell with minimal spills. Sludge would be contained to the lagoon cells.
	Air Quality	Odours from Sludge Transfer	I	Sludge transfer will be of a short time duration, so odour nuisance will be minimal to neighboring residents.
3 Operation of Lagoon	Surface Water	Contamination from Effluent Discharge, Seepage and Spills	I	The wastewater effluent will be treated to meet all provincial and federal guidelines for surface discharge. The operator will test the effluent prior to discharge to ensure that concentrations meet the Environment Act Licence requirements. The lagoon expansion cell will be lined with clay in accordance with provincial requirements to provide containment of wastewater effluent. Liquid levels in the lagoon cells will be monitored to ensure that a minimum freeboard height is maintained, so that effluent is not spilling over the dikes.
		Flooding along Discharge Route	I	If flooding occurs along the discharge route, the lagoon will not be discharged. Treated effluent will not contribute to overland flooding.
	Groundwater	Seepage from Lagoon Cell	I	The lagoon will be lined with soil to the permeability requirements of the Environment Act Licence to ensure containment of the liquid wastewater.
	Social	Operator Training	SP	Operators for the lagoon will be certified to the level specified by the province for the classification of the facultative lagoon. The operators are to work with ECCC and MECP to ensure proper operation, maintenance, sampling/testing and emergency protocols are in place.

4.0 RESIDUAL AND CUMULATIVE EFFECTS

Residual environmental effects remaining after the application of mitigation measures, to the extent possible expressed in quantitative terms relative to baseline conditions

No negative residual effects are anticipated through the construction and operation of the expanded wastewater treatment lagoon, due to the mitigation measures described above. Positive residual effects are expected from a properly sized wastewater treatment system that will allow for expansion of the service area in the future. Positive residual impacts are also expected from the use of local resources and operators.

No negative cumulative effects are anticipated from other construction works in the area. As the existing lagoon discharge route will continue to be utilized, no negative impacts are expected, however, due to the additional hydraulic storage in the proposed primary cell, the discharge period will be longer and a greater volume of effluent will be released during discharge events.

5.0 MONITORING AND FOLLOW-UP

Proposed follow-up activities that will be required at any stage of development (e.g., Monitoring, inspection, surveillance, audit, etc.)

Monitoring of the lagoon operation is to be conducted by a trained lagoon operator, who is to ensure the lagoon is operated under the requirements of the Environment Act licence. The operator is to:

- ensure liquid levels in the lagoon cells are maintained within the required limits
- spread alum in storage cell if needed to reduce phosphorus levels, if phosphorus limits cannot be met at the outlet of the natural wetlands
- conduct sampling of lagoon effluent prior to discharge
- ensure effluent quality parameters as described in the Environment Act licence are met
- maintain records of discharge events and effluent quality monitoring for reporting to MECP, and Environment and Climate Change Canada
- maintain vegetation growth to within limits at the lagoon site
- monitor erosion of slopes.

If there are any concerns with the operation of the lagoon, the licencee is to contact the MECP to discuss mitigation options. The construction contractor is to ensure that grass growth occurs on slopes and disturbed areas, after the construction activities are completed as designed.

6.0 FUNDING AND APPROVALS

Name and address of any Government Agency or program (federal, provincial or otherwise) from which a grant or loan of capital funds have been requested (where applicable). Other federal, provincial or municipal approvals, licences, permits, authorizations, etc. known to be required for the proposed development, and the status of the project's application or approval.

The project is currently being funded by the MECP Parks Branch. Funding will be allocated for construction following approval of the EAP. No additional approvals, licences or permits are required for the lagoon expansion construction and operation. The Parks Branch will also be responsible for registering the lagoon expansion with Environment Canada and providing annual monitoring reports to Environment Canada under the *Federal Wastewater Systems Effluent Regulations*.

7.0 PUBLIC CONSULTATION

Results of any public consultations undertaken or to be undertaken in conjunction with project planning.

Public comments will be received by MECP through the public registry during the Environmental Act Proposal review period.

8.0 CONCLUSION

Based on the design of the project and the implementation of the mitigation measures, identified in Section 3.0 above, no significant negative environmental impacts are anticipated. Positive effects to the environment are expected from a properly sized wastewater treatment lagoon.

The proponent would like to complete the requirements of the Environment Act Proposal as soon as possible so that the lagoon construction can begin during the 2023 construction season.

JR Cousin Consultants Ltd. requests that a draft copy of the Environment Act Licence be forwarded for review prior to the issue of the final licence.

APPENDIX

Appendix A

Email Correspondence, Manitoba Conservation Data Centre – Fish and Wildlife Branch, September 1, 2022

Table A1 – Manitoba Conservation Data Centre's (CDC) Rare Species Database for Paint Lake Provincial Park

Table A2 – Definitions for the Manitoba Conservation Data Centre's (CDC) Rare Species Database

Appendix B

Letter Report for the Paint Lake Provincial Park Wastewater Lagoon Study Geotechnical Investigation, JR Cousin Consultants Ltd, August 16, 2022

Sludge Testing Results, ALS Canada Ltd, 2022

Sludge Survey, Assiniboine Injections Ltd, 2022

Appendix C

Plan 1: Proposed Lagoon Expansion Location with Setbacks

Plan 2: Lagoon Discharge Route

Plan 3: Proposed Lagoon Expansion Layout

Plan 4: Proposed Lagoon Expansion Cross Sections

Appendix A

Email Correspondence, Manitoba Conservation Data Centre – Fish and Wildlife Branch, September 1, 2022

Table A1 – Manitoba Conservation Data Centre's (CDC) Rare Species Database for Paint Lake Provincial Park

Table A2 – Definitions for the Manitoba Conservation Data Centre's (CDC) Rare Species Database

bmccormac@jrcc.ca

From: owohlgemut@jrcc.ca
Sent: October 11, 2022 4:30 PM
To: bmccormac@jrcc.ca
Subject: FW: DR O Wohlgemut Cousin 20220825 Paint lk PP lagoon
Attachments: DR O Wohlgemut Cousin 20220825 Paint lk PP lagoon.xlsx; Paint lk PP and b5k.zip

Oswald Wohlgemut, M.Sc.
Environmental Scientist
J R Cousin Consultants Ltd.
(204) 489-0474

From: Murray, Colin <Colin.Murray@gov.mb.ca>
Sent: Thursday, September 1, 2022 11:42 AM
To: owohlgemut@jrcc.ca
Subject: DR O Wohlgemut Cousin 20220825 Paint lk PP lagoon

Hi Oswald
Thank you for your information request. I completed a search of the Manitoba Conservation Data Centre's (CDC) rare species database for your area of interest. This includes the primary location: Paint Lake Provincial Park; and a 5km radius buffer from the park boundary.

I am attaching a Microsoft Excel spreadsheet summarizing these occurrences. The spreadsheet includes scientific and common names, the provincial (SRank) rank for each species as well as the Manitoba Endangered Species and Ecosystem Act, and the federal Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and Species at Risk Act (SARA) designations. I'm also including the ESRI Shapefiles used to fulfill the request.

Further information on this ranking system can be found on our website at: http://www.natureserve.org/conservation-tools/conservation-status-assessment.
These designations can be found at:
http://web2.gov.mb.ca/laws/statutes/ccsm/e111e.php,
https://www.cosewic.ca/index.php/en-ca/ and
http://www.sararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1.

Manitoba's recommended setback distances can be found at:
https://www.gov.mb.ca/fish-wildlife/cdc/pubs/mbcdc-bird-setbacks-nov2021.pdf.

The information provided in this letter is based on existing data known to the Manitoba Conservation Data Centre of the Wildlife and Fisheries Branch at the time of the request. These data are dependent on the research and observations of CDC staff and others who have shared their data, and reflect our current state of knowledge. An absence of data does not confirm the absence of any rare or endangered species. Many areas of the province have never been thoroughly surveyed, therefore, the absence of data in any particular geographic area does not necessarily mean that species or ecological communities of concern are not present. The information should not be regarded as a final statement on the occurrence of any species of concern, nor should it substitute for on-site surveys for species or environmental assessments. Also, because our Biotics database is continually updated and because information requests are evaluated by type of action, any given response is only appropriate for its respective request.

Please contact the Manitoba CDC for an update on this natural heritage information if more than six months passes before it is utilized.

Third party requests for products wholly or partially derived from our Biotics database must be approved by the Manitoba CDC before information is released. Once approved, the primary user will identify the Manitoba CDC as data contributors on any map or publication using data from our database, as the Manitoba Conservation Data Centre; Wildlife and Fisheries Branch, Manitoba Sustainable Development.

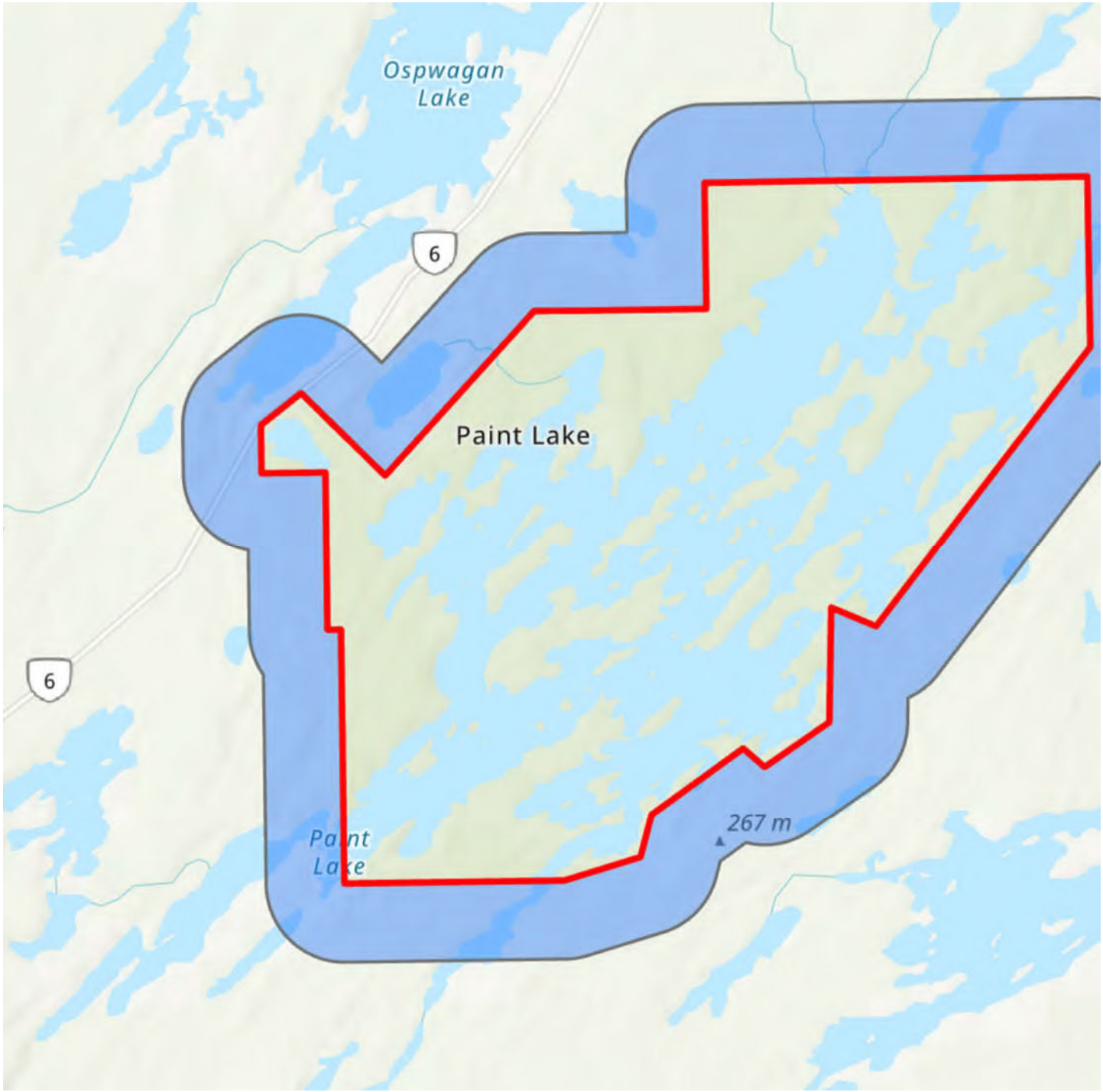
This letter is for information purposes only - it does not constitute consent or approval of the proposed project or activity, nor does it negate the need for any permits or approvals required by the Province of Manitoba.

We would be interested in receiving a copy of the results of any field surveys that you may undertake, to update our database with the most current knowledge of the area.

If you have any questions or require further information contact me directly at (204) 945-7760.

Colin

Reference screen clip:



Colin Murray
Information Manager- Manitoba Conservation Data Centre
Fish and Wildlife Branch, Natural Resources and Northern Development
200 Saulteaux Crescent, Winnipeg, MB R3J3W3
T: 204-945-7760 **F**: 204-945-3077

From: owohlgemut@jrcc.ca <owohlgemut@jrcc.ca>
Sent: August 25, 2022 11:27 AM
To: Murray, Colin <Colin.Murray@gov.mb.ca>
Subject: Paint Lake Campground Lagoon Project - Species at Risk

Hello Colin,

Would you be able to provide us with a review of the provincial database regarding wildlife, bird or plant species at risk or sensitive habitat areas in the The Parks Branch is proposing the expansion of the existing wastewater lagoon and the development area will be a forested area adjacent to the existing lagoon cells.

Please let us know if you have any questions.

Cheers,

Oswald Wohlgemut, M.Sc.
Environmental Scientist
J R Cousin Consultants Ltd.
(204) 489-0474

Table A1 - Manitoba Conservation Data Centre's (CDC) Rare Species Database for Paint Lake Provincial Park

SEARCH CRITERIA	SITE	SCINAME	COMNAME	S_RANK	ESEA	SARA	COSEWIC	FIRSTOBS	LASTOBS	EO_RANK	REPACC
Within	Paint Lake Provincial Park	Rangifer tarandus carib	Woodland Caribou	S2S3	Threatened	Threatened	Threatened			E - Verified extant (viabilit	High
Within	Paint Lake Provincial Park	Bombus terricola	Yellow-banded Bumble Bee	S3S5		Special Concern	Special Concern	1989-07-10	1989-07-10	H - Historical	Very Low
Within	Paint Lake Provincial Park	Gull Colony		SNR				2011-07-08	2011-07-08	E - Verified extant (viabilit	High
Within	Paint Lake Provincial Park	Tern Colony		SNRB				2011-07-08	2011-07-08	E - Verified extant (viabilit	High
Within	Paint Lake Provincial Park	Bombus bohemicus	Ashton Cuckoo Bumble Bee	S1		Endangered	Endangered	1989-07-10	1989-07-10	H - Historical	Unknown
Within	Paint Lake Provincial Park	Sorex obscurus	a dusky shrew	S3				1970-1977	1970-1977	B - Good estimated viabili	Very Low
Within 5km radius of site boundary of	Paint Lake Provincial Park	Rangifer tarandus carib	Woodland Caribou	S2S3	Threatened	Threatened	Threatened			E - Verified extant (viabilit	High
Within 5km radius of site boundary of	Paint Lake Provincial Park	Contopus cooperi	Olive-sided Flycatcher	S2S3B	Threatened	Threatened	Special Concern	2012-06-29	2012-06-29	E - Verified extant (viabilit	Medium
Within 5km radius of site boundary of	Paint Lake Provincial Park	Bombus terricola	Yellow-banded Bumble Bee	S3S5		Special Concern	Special Concern	1989-07-10	1989-07-10	H - Historical	Very Low
Within 5km radius of site boundary of	Paint Lake Provincial Park	Bombus bohemicus	Ashton Cuckoo Bumble Bee	S1		Endangered	Endangered	1989-07-10	1989-07-10	H - Historical	Unknown
Within 5km radius of site boundary of	Paint Lake Provincial Park	Sorex obscurus	a dusky shrew	S3				1970-1977	1970-1977	B - Good estimated viabili	Very Low

Table A2 - Definitions for the Manitoba Conservation Data Centre's (CDC) Rare Species Database

Attribute	Definition
SEARCH CRITERIA	Criteria used to conduct a species search applied to the site or area of interest.
SITE	Location or area of interest provided in a data request used to conduct a species search by applying various criteria.
SCINAME	Scientific name.
COMNAME	Common name.
S_RANK	Subnational (provincial) conservation status ranks. Ranks the species's rarity on a scale of 1 (rare) to 5 (common).
ESEA	Provincial Endangered Species and Ecosystems Act listing.
SARA	Federal Species at Risk Act listing.
COSEWIC	Committee on the Status of Endangered Wildlife in Canada recommendation.
FIRSTOBS	Date species first observed for the element occurrence (YYYY-MM-DD).
LASTOBS	Date species last observed for the element occurrence (YYYY-MM-DD).
EO_RANK	The Element Occurrence Rank Specifications are an assessment of the viability of species occurrences, or the ecological integrity of community occurrences.
REPACC	Value that indicates the average level of accuracy of the Source Features for an EORep. Accuracy varies on the basis of the area observed to be occupied by the Element (Field Observation) relative to the area contained within the footprint of the Source Feature.
NOTES	Notes or comments related to the listed species

Appendix B

Letter Report for the Paint Lake Provincial Park Wastewater Lagoon Study Geotechnical Investigation, JR Cousin Consultants Ltd, August 16, 2022

Sludge Testing Results, ALS Canada Ltd, 2022

Sludge Survey, Assiniboine Injections Ltd, 2022

Letter Report for the Paint Lake Provincial Park Wastewater Lagoon Study Geotechnical Investigation, JR Cousin Consultants Ltd, August 16, 2022

August 16, 2022

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Ms. Rebecca Toews, EIT
Water Services Branch
Department of Central Services
Unit 1A – 2010 Currie Blvd.
Brandon, Manitoba
R7B 4E7

P-426.02

P&R 14.85 JRCC

Via email

Dear Ms. Toews,

RE: Letter Report for the Paint Lake Provincial Park Wastewater Lagoon Study Geotechnical Investigation

JR Cousin Consultants Ltd. (JRCC) conducted a geotechnical investigation of the wastewater treatment lagoon for the Paint Lake Provincial Park as part of the wastewater lagoon study and EAP project. The geotechnical investigation occurred on the existing lagoon dikes and to the northwest and west of the existing lagoon cells, on Crown land. The investigation reviewed the site and soil conditions present in the existing lagoon dike and in the areas of potential lagoon expansion, if needed. Any new lagoon cell will require a properly designed liner meeting provincial approval and the soils investigation was to determine potential liner requirements.

1.0 BACKGROUND

The Paint Lake Provincial Park wastewater treatment lagoon is located approximately 36 km south of Thompson, Manitoba and is located adjacent to the campground and cottage development along Paint Lake. The existing lagoon cells are located approximately 200 m from Liz Lake and 215 m from Paint Lake. The campground utilizes a gravity sewer collection system with several lift stations that pump to the lagoon primary cell. Private cottages also use the lagoon via a septic hauling service.

Manitoba Environment, Climate and Parks (MBECP) indicated that the northwest corner of Secondary Cell 1 was visibly wet in 2021, which they suspect was from the lagoon leaking. This is also the portion of the lagoon cell where the discharge pipe runs above ground, as it extends to the north of the lagoon into the forested land. A test hole was completed within the existing lagoon dike at the area of suspected leakage to evaluate the soils used to construct the lagoon.

Due to the expanding cottage development, the lagoon will require expansion to meet the service demands. The only area that could be used for the expansion, due to setbacks, is northwest of the lagoon cells.

Background soils information from the Manitoba Soil Survey Report (No. D32) indicated that the soils in the area of the existing lagoon and potential lagoon expansion consisted of:

- Wabowden Series – Moderately to strongly calcareous clay textured lacustrine sediments with fine silt varves. These soils are moderately well drained and occur in gently sloped areas. Runoff is moderate and soil permeability is very slow in the subsoil.
- Sipiwesk Series – Moderately to strongly calcareous clay textured lacustrine sediments with silt varves. These soils are moderately well drained and occur in moderately sloped areas. Runoff is moderate and soil permeability is very slow in the subsoil.

- La Perouse Series – Moderately to strongly calcareous clay textured lacustrine sediments. These soils are poorly drained and occur in very gently sloped areas. Runoff is very slow and soil permeability is very slow in the subsoil. These soils may have up to 0.4 m of peat at the soil surface.

Manitoba Environment, Climate and Parks did not have any design or construction drawings of the existing lagoon cells and there were no records of past geotechnical studies conducted at the site.

2.0 GEOTECHNICAL FIELD INVESTIGATION

An onsite investigation of geotechnical conditions was conducted by JRCC on March 31, 2022. A drill rig was used for drilling the test holes under the direct supervision of JRCC personnel. During the site investigation, seven test holes were excavated to a maximum depth of 6.0 m with a solid stem auger. One test hole was drilled in the northwest corner dike of Secondary Cell 1, where there was suspected leakage occurring. The remainder of the test holes were drilled in the forested land to the northwest of the lagoon cells. The test hole locations are shown on the attached plan.

The lagoon is surrounded by forest land on all sides, with two separate access roads located to the south and east. The park Public Works Yard is located to the southeast of the lagoon cells. Several pieces of used equipment and structures were located on the northwest side of the lagoon dike. There was also an above-ground fuel storage tank located on the southeast corner of the lagoon cells. The lagoon discharges from a portable pump, through a buried pipe, to the north of the lagoon cells. This discharge pipe is shallow buried and is exposed at the surface in the northwest corner of Secondary Cell 1.

The subsurface soil profile within each test hole was logged, water conditions were noted, and representative soil samples were collected from the drill auger as the soils varied along the profile. An assessment of the short-term groundwater conditions was completed by measuring the groundwater infiltration level in the test holes. All test holes were then backfilled with bentonite. Details of each test hole soil profile, including depth and description of each soil layer, can be found in the attached test hole logs.

2.1 Soil Profile

Based on the soils observed in the test holes, the subsurface soil profile was fairly consistent in the potential expansion area to the northwest. The general soil profile consisted of surficial peat, followed by high plastic clay to bottom of the test holes. The surficial layer of peat was deeper and more wet in the lower lying test holes further south and west (TH5 and TH7). The test hole in the lagoon dike (TH1) consisted of high plastic compacted clay from the surface down to the bottom of the test hole. The following table summarizes the general soil profile observed across the potential expansion area.

Primary Soil Type	Average Depth Range of Soil Layer	Secondary Soil Characteristics
Peat	0 m – 0.2 m	Silt
Clay (high plastic)	0.2 m – 6.0 m	Silt

Details of the soil profile observed in each test hole are attached in the test hole logs.

2.2 Groundwater and Bedrock

Groundwater infiltration was not observed from the surface in the test holes, but the wetter conditions in the soil were observed at a depth of approximately 3.0 m. below the surface. Bedrock or refusal was not encountered in any of the test holes.

If site construction works occur, contractors should be made aware of the geotechnical conditions encountered onsite.

3.0 LABORATORY TESTING, ANALYSIS AND DISCUSSION

Representative soil samples from the potential expansion area were submitted to Wood Environment and Infrastructure Solutions Inc. for testing and analysis. The following is a summary of the testing results, while the detailed laboratory results are attached.

Four bagged samples were analyzed for the following:

- Atterberg Limits (plastic limit, liquid limit, and plasticity index, ASTM D4318)
- Soil Classification (ASTM D2487)
- Moisture Content (ASTM D2216)
- Particle Size Analysis (Hydrometer test, ASTM D422).

Two Shelby tube samples were analyzed for hydraulic conductivity (ASTM 5084).

Details of the soil sample analysis are included in the attached laboratory report. A summary of the laboratory results are as follows:

Test Hole	Depth of Sample (m)	Liquid Limit	Plastic Limit	Plasticity Index	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
TH1	1.5 – 3.0	55	20	35	0	1	17	82
TH4	0.2 – 3.2	59	19	40	0	0	14	85
TH4	3.2 – 6.0	33	16	17	0	1	50	49
TH6	0.2 – 4.7	57	21	36	0	0	41	59

The Shelby tube sample from the layer of clay till at TH4 1.5 m – 1.9 m obtained a hydraulic conductivity value of 1.09 x 10^{-8} cm/sec. The Shelby tube sample from the layer of clay till at TH4 3.4 m – 3.8 m obtained a hydraulic conductivity value of 5.90 x 10^{-8} cm/sec.

From previous experience, soils with the following characteristics would likely provide a liner with a hydraulic conductivity of 1 x 10^{-7} cm/sec or less:

- Liquid limit of 30% or greater
- Plastic limit of 10% or greater
- 30% or more passing a number 200 mesh sieve (silt and clay)
- 20% or more of clay particles.

The clay till material tested met the characteristics described above, and the in situ Shelby tube samples from the same layers of material also met the provincial hydraulic conductivity requirement. It is therefore likely that the clay material throughout the profile would meet provincial requirements for hydraulic conductivity (1×10^{-7} cm/sec or less) in an undisturbed or reworked state.

4.0 LAGOON CELL LINER REQUIREMENTS

4.1 Current Guidelines

The Province of Manitoba *Design Objectives for Wastewater Treatment Lagoons* provides guidelines and requirements for lagoon design, including a lagoon liner. A lagoon liner should have a minimum thickness of 1.0 m of soil material meeting a hydraulic conductivity (i.e. the potential rate of fluid movement through the soil) of 1×10^{-7} cm/sec or less. This low permeability rate is required to protect the underlying groundwater from wastewater seepage. The liner of a lagoon cell can be constructed using in situ (undisturbed native) soils, if the soils can consistently achieve a hydraulic conductivity of 1×10^{-7} cm/sec or less in their in situ state. If in situ soils cannot achieve the required hydraulic conductivity, a cell liner can be constructed by excavating and reworking suitable clay type soils to form the liner, or utilizing a synthetic geomembrane liner. Any lined cell should also have a minimum separation distance of 1.0 m from the bottom of the cell floor to the static groundwater level. It is not recommended to utilize bedrock as a lagoon liner, due to possible fissures or cracks in the rock which could create a permeable pathway to the local groundwater table.

4.2 Cell Liner Design

Based on the results of the onsite investigation and laboratory analysis, it is recommended to construct the floor liner of an expansion cell to the northwest of the existing cells with in situ (undisturbed) soils, at the desired excavation depth for the cell floor. A vertical cut-off wall of re-compacted soils is recommended for the perimeter liner, which would tie into the cell floor liner.

The soils forming the horizontal liner (lagoon cell floor) and vertical liner (cut-off wall) are to have a minimum thickness of 1.0 m. The vertical cut-off wall is recommended to have a minimum thickness of 3.0 m, to accommodate typical soil compaction equipment and vehicle access on the top of the dikes.

4.3 Utilization of Onsite Soils

In the potential lagoon expansion area, the surficial topsoil material should be stripped from the cell construction area and stockpiled for use as top dressing on the outer slopes of the dikes. Any low plastic silt or sand material excavated should be utilized in construction of the interior or exterior dike slopes. The clay material excavated should be used to construct the vertical cut-off walls in the perimeter dikes, and the in situ clay till material should be scarified and compacted to form the cell floor. Any unsuitable material (boulders, sand, gravel) should be removed if discovered, and replaced with suitable clay material.

The cell dike construction would require that soils not be too wet or too dry and that they be compacted to a minimum of 98% of the maximum Standard Proctor Density in maximum 150 mm lifts.

4.4 Existing Lagoon Cell Liner

There were no design or construction drawings available for the existing lagoon cells, and no documentation regarding how the lagoon was constructed or lined. However, from site observations of the test hole conducted in the northwest corner of Secondary Cell 1, it appears that the lagoon was constructed with the surrounding high plastic clay soils throughout the profile of the lagoon dike. The laboratory analysis of these soils indicated that they would meet the provincial hydraulic conductivity requirements for a lagoon liner. It is therefore unlikely that there is leakage occurring through the dike.

5.0 CONCLUSIONS, RECOMMENDATIONS AND CLOSURE

5.1 Conclusions and Recommendations

From a review of the test hole in the existing lagoon dike, it is unlikely that leakage is occurring through the dike in the northwest corner of Secondary Cell 1. It is more likely that the leakage is occurring from the discharge pipe located at the surface in that area.

The soils to the northwest and west of the existing lagoon cells were tested for suitability in construction of a new expansion cell. Based on the site observations and laboratory results, it is recommended that the native clay soils throughout the area be used for construction of a cell liner of in situ (undisturbed) clay material and re-worked clay material for the vertical cut-off wall in the perimeter dikes. Any unsuitable materials excavated or observed in the cell liner should be removed and replaced with suitable clay material. If possible, setbacks should be maintained from the nearby cottages to the southeast.

5.2 Closure

The conclusions and recommendations in this report are based on the results of the site investigation and laboratory analysis. In addition, soil and groundwater conditions between test hole locations were generalized to provide an overall assessment of the geotechnical site conditions. If conditions appear different from those encountered at the test hole locations as described in this report, or if the assumptions stated herein are not in agreement with the design, JRCC should be informed so that the recommendations can be reviewed and adjusted as required.

The geotechnical site investigation was conducted to identify soil conditions suitable for use in constructing a new lagoon cell. Although no environmental issues were identified during the geotechnical investigation, it does not necessarily follow that such issues do not exist.

It is not uncommon for soil conditions to be highly variable across a site. Previous construction activities and placement of fill at a site can augment the variability of soil conditions, especially surficial soil conditions. Bedrock depth and groundwater conditions can also vary significantly across the site. A contingency must be included in any construction budget to allow for potential variations in soil conditions, which may result in modification of the design and construction procedures.

If you have any questions, please contact the undersigned.

Yours truly,

JR Cousin Consultants Ltd.

[redacted]

Oswald Wohlgemut, M.Sc.
Environmental Scientist

Reviewed by

[redacted]

Brett McCormac, P.Eng.
Environmental Engineer

Attach: Plan 1: Test Hole Location Plan

Test Hole Logs

Laboratory Analysis Results, Wood Environment and Infrastructure Solutions

[redacted]

APPENDIX

Plan 1: Test Hole Location Plan

Test Hole Logs

Laboratory Test Results, Wood Environment and Infrastructure Solutions Inc.

Plan 1: Test Hole Location Plan

SCALE BAR
(IN METRES)

20 0 10 20 40 60 80 100

1:1000

No.	REVISIONS	DATE	INITIALS
			B.M. EL.

LOCATIONS OF UNDERGROUND STRUCTURES/UTILITIES AS SHOWN ARE BASED ON AVAILABLE INFORMATION BUT NO GUARANTEE IS GIVEN OR IMPLIED THAT ALL EXISTING UNDERGROUND STRUCTURES/UTILITIES ARE SHOWN OR THAT THE GIVEN LOCATIONS ARE EXACT. CONFIRMATION OF EXISTENCE AND EXACT LOCATION OF ALL UNDERGROUND STRUCTURES/UTILITIES MUST BE OBTAINED FROM THE APPROPRIATE AUTHORITY/OWNER, BY THE CONTRACTOR, BEFORE PROCEEDING WITH CONSTRUCTION.

ENGINEER'S SEAL

PRELIMINARY

JR Cousin Consultants Ltd.
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f. (204) 489-0487
www.jrcc.ca
ENGINEERING CONSULTANTS
ENGINEERING EXCELLENCE SINCE 1981

CODE:	P-426.02
DESIGNED BY:	OW
DRAWN BY:	OT
REVIEWED BY:	OW

PROJECT: PAINT LAKE PP
WASTEWATER LAGOON STUDY AND EAP

TITLE: TEST HOLE LOCATION PLAN

SCALE:	DATE:	PLAN:	SHEET:
1:1000	22/06/20	1	1 of 1

Aug 16, 2022 - 8:36am G:\AOC\426 Paint Lake PP\426.02 Wastewater Lagoon Study and EAP\04 Drawings\Arc\Geotechnical\Test Hole Location Plan.dwg

Test Hole Logs

J. R. Cousin Consultants Ltd.

TEST HOLE LOGS

SYMBOL INDEX


GW. : Well graded gravels and gravel sand mixtures, little or no fines


GP. : Poorly graded gravels, gravel - sand mixtures, little or no fines


GM. : Silty gravels, gravel-sand-silt mixtures


GC. : Clayey gravels, gravel-sand-clay mixtures


SW. : Well graded sands, gravelly sands, little or no fines


SP. : Poorly graded sands, or gravelly sands, little or no fines


SM. : Silty sands, sand-silt mixtures


SC. : Clayey sands, sand-clay mixtures


ML. : Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity


CL. : Inorganic clays of low plasticity, gravelly clays, sandy or silty clays, lean clays


OL. : Organic silts and organic silty clays of low plasticity


CI. : Inorganic clays of medium or intermediate plasticity


MH. : Inorganic silts, fine sandy or silty soils


CH. : Inorganic clays of high plasticity, fat clays


OH. : Organic clays of medium to high plasticity, organic silts


Pt. : Peat, humus, swamp soils with high organic contents


TOPSOIL

The soil logs are based upon objective data available to us at the time of forming our opinions The soil logs indicate site specific soil characteristics and must not be generalized over larger areas due to the limited number of test holes as compared to that of an unlimited number of test holes Every effort is made to evaluate the information by methods generally recognized The soil logs represent our opinions J R Cousin Consultants Ltd cannot be responsible for actual site conditions proved to be materially at variance from our analysis or from the data generalization over untested areas

J. R. Cousin Consultants Ltd.

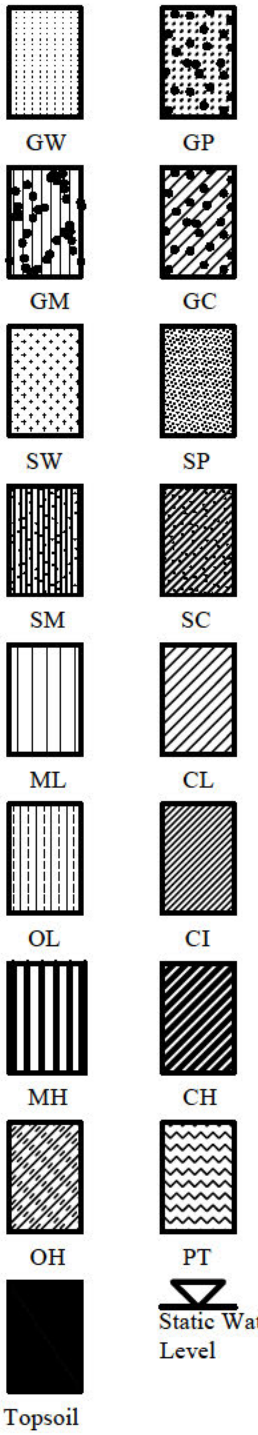
TEST HOLE LOG SHEET

LOCATION : Paint Lake Lagoon Dike
CODE: P-426.02
DATE : March 31, 2022

COORDINATES: 6150664N, 561300E
ELEVATION: 201.986m

PROJECT : Paint Lake Wastewater Lagoon Study and EAP
METHOD OF SAMPLING: Drill Rig
TEST HOLE # 1

DEPTH OF SAMPLE	FIELD CLASSIFICATION
0m / 0	
2'	
1m	
4'	
	CLAY - Brown, high plastic, silt, stiff, damp
6'	
2m	
8'	
3m	
10'	- Test hole ended at 3.0m
12'	
4m	
14'	
16'	
5m	
18'	
6m	
20'	



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J. R. Cousin Consultants Ltd.

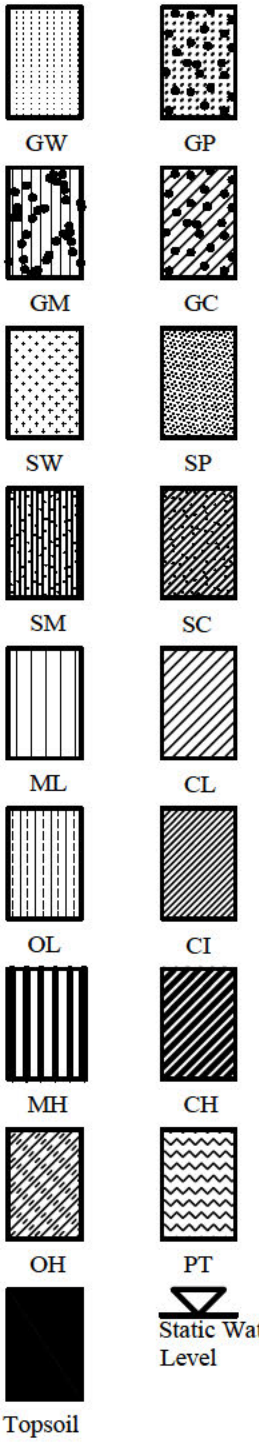
TEST HOLE LOG SHEET

LOCATION : Paint Lake Lagoon Dike
CODE: P-426.02
DATE : March 31, 2022

COORDINATES: 6150936N, 561392E
ELEVATION: 202.777m

PROJECT : Paint Lake Wastewater Lagoon Study and EAP
METHOD OF SAMPLING: Drill Rig
TEST HOLE # 2

DEPTH OF SAMPLE	FIELD CLASSIFICATION
0m / 0	PEAT - Brown, organics, damp
2'	
1m / 4'	CLAY - Brown, high plastic, silt, stiff, damp
6'	
2m / 8'	
3m / 10'	
12'	
4m / 14'	CLAY - Brown, high plastic, silty, firm, moist
16'	
5m / 18'	
6m / 20'	- Test hole ended at 6.0m



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J. R. Cousin Consultants Ltd.

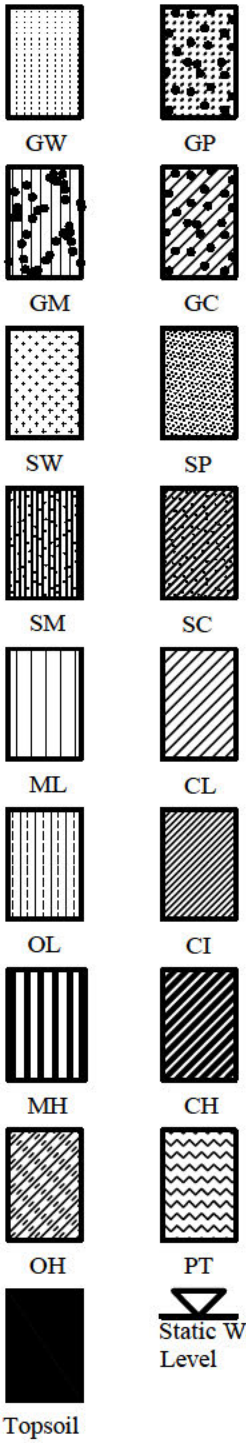
TEST HOLE LOG SHEET

LOCATION : Paint Lake Lagoon Dike
CODE: P-426.02
DATE : March 31, 2022

COORDINATES: 6150875N, 561464E
ELEVATION: 203.658m

PROJECT : Paint Lake Wastewater Lagoon Study and EAP
METHOD OF SAMPLING: Drill Rig
TEST HOLE # 3

DEPTH OF SAMPLE	FIELD CLASSIFICATION
0m / 0	PEAT - Brown, organics, damp
2'	
1m / 4'	CLAY - Brown, high plastic, silt, stiff, damp
6'	
2m / 8'	
3m / 10'	
12'	
4m / 14'	CLAY - Brown, high plastic, silty, firm, moist
16'	
5m / 18'	
6m / 20'	- Test hole ended at 6.0m



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J. R. Cousin Consultants Ltd.

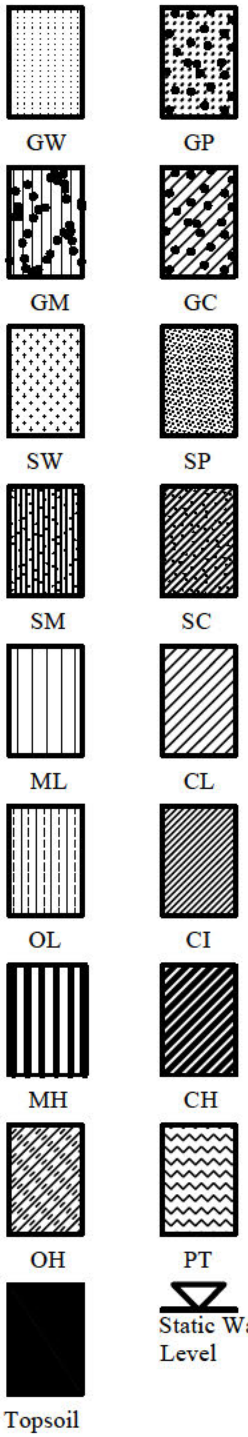
TEST HOLE LOG SHEET

LOCATION : Paint Lake Lagoon Dike
CODE: P-426.02
DATE : March 31, 2022

COORDINATES: 6150877N, 561359E
ELEVATION: 201.308m

PROJECT : Paint Lake Wastewater Lagoon Study and EAP
METHOD OF SAMPLING: Drill Rig
TEST HOLE # 4

DEPTH OF SAMPLE		FIELD CLASSIFICATION
0m	0	PEAT - Brown, organics, damp
	2'	
1m		
	4'	CLAY - Brown, high plastic, silt, stiff, damp
	6'	
2m		
	8'	
3m	10'	
	12'	
4m		
	14'	CLAY - Brown, high plastic, silty, firm, moist
	16'	
5m		
	18'	
6m	20'	- Test hole ended at 6.0m



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J. R. Cousin Consultants Ltd.

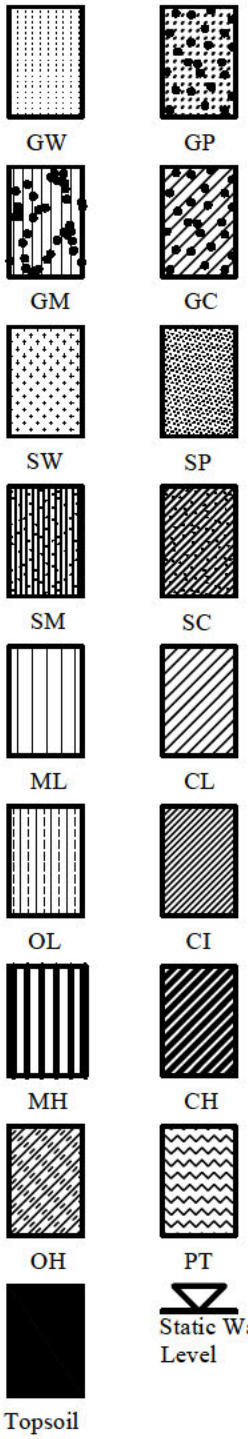
TEST HOLE LOG SHEET

LOCATION : Paint Lake Lagoon Dike
CODE: P-426.02
DATE : March 31, 2022

COORDINATES: 6150798N, 561281E
ELEVATION: 198.094m

PROJECT : Paint Lake Wastewater Lagoon Study and EAP
METHOD OF SAMPLING: Drill Rig
TEST HOLE # 5

DEPTH OF SAMPLE	FIELD CLASSIFICATION
0m / 0	PEAT - Black, silty, organics, wet
2'	
1m / 4'	
6'	
2m / 8'	
3m / 10'	CLAY - Brown, high plastic, silt, stiff, damp
12'	
4m / 14'	
16'	
5m / 18'	
6m / 20'	- Test hole ended at 6.0m



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J. R. Cousin Consultants Ltd.

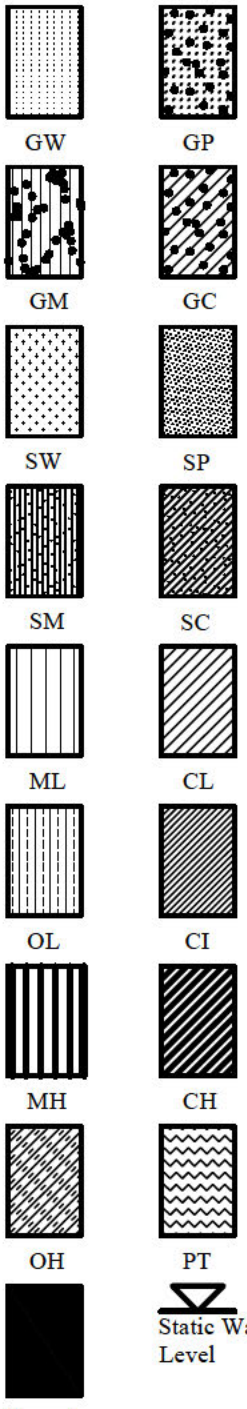
TEST HOLE LOG SHEET

LOCATION : Paint Lake Lagoon Dike
CODE: P-426.02
DATE : March 31, 2022

COORDINATES: 6150712N, 561243E
ELEVATION: 197.023m

PROJECT : Paint Lake Wastewater Lagoon Study and EAP
METHOD OF SAMPLING: Drill Rig
TEST HOLE # 6

DEPTH OF SAMPLE	FIELD CLASSIFICATION
0m / 0	PEAT - Black, silty, organics, wet
2'	
1m	
4'	CLAY - Brown, high plastic, silty, stiff, damp
6'	
2m	
8'	
3m	
10'	
12'	
4m	
14'	
16'	
5m	
18'	CLAY - Brown, high plastic, silty, firm, moist
6m / 20'	- Test hole ended at 6.0m



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J. R. Cousin Consultants Ltd.

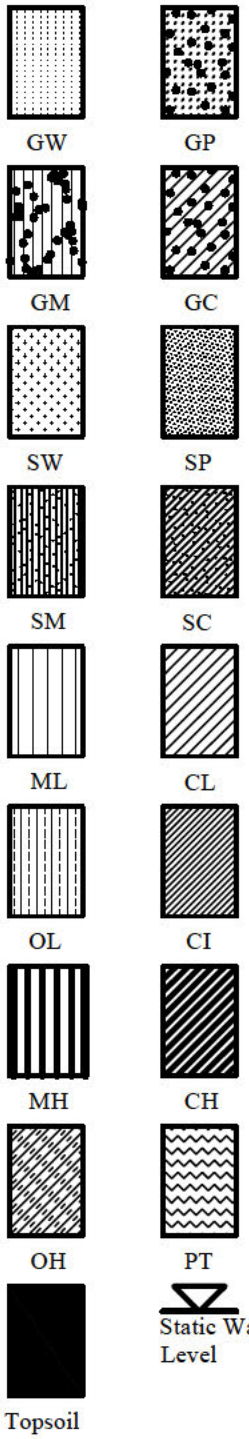
TEST HOLE LOG SHEET

LOCATION : Paint Lake Lagoon Dike
CODE: P-426.02
DATE : March 31, 2022

COORDINATES: 6150792N, 561177E
ELEVATION: 198.739m

PROJECT : Paint Lake Wastewater Lagoon Study and EAP
METHOD OF SAMPLING: Drill Rig
TEST HOLE # 7

DEPTH OF SAMPLE	FIELD CLASSIFICATION
0m / 0	PEAT - Black, silty, organics, wet
2'	
1m / 4'	
6'	
2m	CLAY - Brown, high plastic, silty, stiff, damp
8'	
3m / 10'	
12'	
4m / 14'	
16'	
5m	CLAY - Brown, high plastic, silty, firm, moist
18'	
6m / 20'	- Test hole ended at 6.0m



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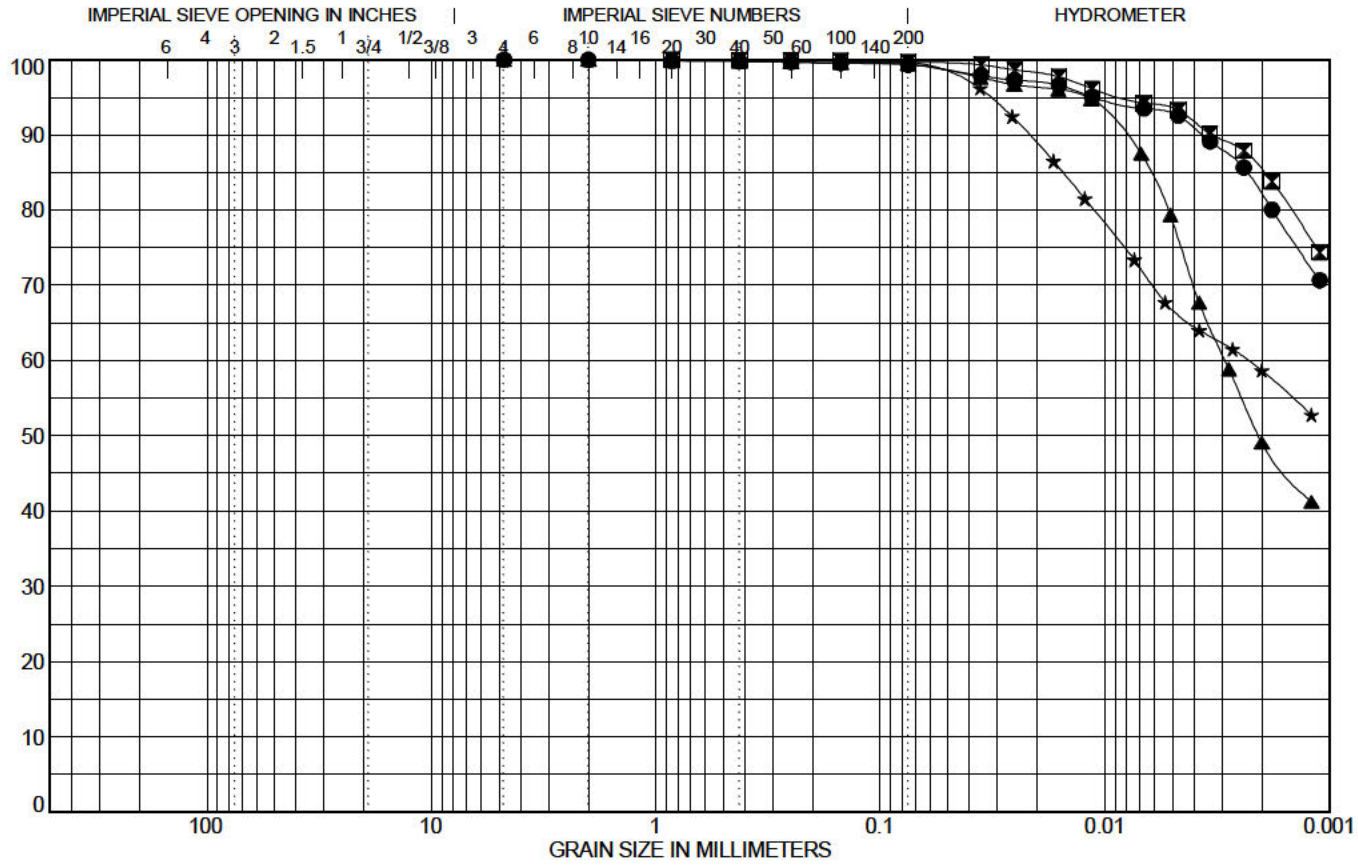
Laboratory Test Results, Wood Environment and Infrastructure Solutions Inc.

PARTICLE SIZE ANALYSIS

Report Date: 26 May 2022

Client		Project	
Name:	JRCC	**Name:**	Paint Lake Provincial Park Expansion
Address:		**Address:**	
Attention:		**Project No.:**	WX11334.5000
PO Number:		**Manager:**	JW

Gradation Specification:



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample ID	mUSCS	MC	D100	D60	D30	D10	LL	PL	% Gravel	% Sand	% Fines
●	TH01, 1.5 m	CH	30.1	4.8				55	20	0	1	17 (Silt) : 82 (Clay)
⊠	TH04, 0.2 m	CH	30.9	0.9				59	19	0	0	14 (Silt) : 85 (Clay)
▲	TH04, 3.2 m	CH	32.1	4.8	0			33	16	0	1	50 (Silt) : 49 (Clay)
★	TH06, 0.2 m	CH	37.1	4.8	0			57	21	0	0	41 (Silt) : 59 (Clay)

ASTM D5084 - HYDRAULIC CONDUCTIVITY REPORT

wood.

TO: Oswald Wohlgemut
JR Cousin Consultants Ltd
91 Scurfield Boulevard
Winnipeg, MB R3Y 1G4

PROJECT NO: WX11334.5000
CLIENT: JRCC
DATE SUBMITTED:

PROJECT: Paint Lake Provincial Park Expansion

SAMPLE: Undisturbed Clay
SAMPLE NO.: P426.02
SAMPLE DEPTH: 1.5-1.9m

PERMEANT: De-Aired Tap Water
HYDRAULIC GRADIENT: 29.11

CONSTANT HEAD METHOD (K = cQL/thA)

	Sample Height, L (cm)	Sample Dia. (cm)	Water Content (%)	Dry Density (kg/m^3)	Degree of Saturation (%)	Cell Pressure (kPa)	Back Pressure (kPa)	Differential Pressure, h (kPa)
Initial	7.24	7.27	28.6%	1546	103.6%	241.4	196.5	20.7
Final	7.49	7.29	29.8%	1498	100.1%			

Date & Time		Time, t	Flow (Q)		Temp. Corr, c	Hyd. Cond. Corrected, K (cm/s)
Start	End	(seconds)	Influent (ml)	Effluent (ml)		
4/25/22 8:00 AM	4/25/22 4:30 PM	30600	0.40	0.45	1.219	1.40E-08
4/25/22 4:30 PM	4/26/22 8:00 AM	55800	0.70	0.80	0.925	1.03E-08
4/26/22 8:00 AM	4/26/22 4:30 PM	30600	0.45	0.50	0.907	1.17E-08
4/26/22 4:30 PM	4/27/22 8:00 AM	55800	0.75	0.90	0.925	1.13E-08
4/27/22 8:00 AM	4/27/22 4:00 PM	28800	0.40	0.45	0.943	1.15E-08
4/27/22 4:00 PM	4/28/22 8:00 AM	57600	0.75	0.85	0.925	1.06E-08
4/28/22 8:00 AM	4/28/22 3:35 PM	27300	0.35	0.40	0.907	1.03E-08

Average Temperature Corrected Value (cm/s): 1.09E-08

Wood Environment & Infrastructure Solutions

Per: [redacted]

Jorden Wiwcharyk, P.Eng.
Geotechnical Engineer

Reporting of these results constitutes a testing service only.
Engineering interpretation or evaluation of the test results is provided only on written request.

Amec Foster Wheeler Environment & Infrastructure
440 Dovercourt Drive
Winnipeg, Manitoba
R3Y 1N4

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ASTM D5084 - HYDRAULIC CONDUCTIVITY REPORT

wood.

TO: Oswald Wohlgemut
JR Cousin Consultants Ltd
91 Scurfield Boulevard
Winnipeg, MB R3Y 1G4

PROJECT NO: WX11334.5000
CLIENT: JRCC
DATE SUBMITTED:

PROJECT: Paint Lake Provincial Park Expansion

SAMPLE: Undisturbed Clay
SAMPLE NO.: P426.02
SAMPLE DEPTH: 3.4-3.8 m

PERMEANT: De-Aired Tap Water
HYDRAULIC GRADIENT: 27.17

CONSTANT HEAD METHOD (K = cQL/thA)

	Sample Height, L (cm)	Sample Dia. (cm)	Water Content (%)	Dry Density (kg/m^3)	Degree of Saturation (%)	Cell Pressure (kPa)	Back Pressure (kPa)	Differential Pressure, h (kPa)
Initial	7.76	7.25	31.1%	1452	97.6%	241.4	196.5	20.7
Final	7.74	7.23	32.2%	1449	100.7%			

Date & Time		Time, t	Flow (Q)		Temp. Corr, c	Hyd. Cond. Corrected, K (cm/s)
Start	End	(seconds)	Influent (ml)	Effluent (ml)		
5/9/22 5:00 PM	5/10/22 7:45 AM	53100	4.50	4.50	1.225	9.27E-08
5/10/22 7:45 AM	5/10/22 4:30 PM	31500	2.55	2.60	0.962	7.02E-08
5/10/22 4:30 PM	5/11/22 8:00 AM	55800	3.90	3.95	0.962	6.04E-08
5/11/22 8:00 AM	5/11/22 5:00 PM	32400	2.25	2.35	0.949	6.02E-08
5/11/22 5:00 PM	5/12/22 7:45 AM	53100	3.40	3.50	0.943	5.47E-08
5/12/22 7:45 AM	5/13/22 7:15 AM	84600	5.70	5.90	0.949	5.81E-08
5/13/22 7:15 AM	5/14/22 9:00 AM	92700	5.90	6.10	0.962	5.56E-08
5/14/22 9:00 AM	5/16/22 9:15 AM	173700	12.70	12.90	0.962	6.33E-08
5/16/22 9:15 AM	5/17/22 8:15 AM	82800	6.30	6.40	0.956	6.54E-08
5/17/22 8:15 AM	5/18/22 9:30 AM	90900	5.50	5.60	0.956	5.21E-08
5/18/22 9:30 AM	5/19/22 6:00 PM	117000	7.60	7.60	0.956	5.54E-08

Average Temperature Corrected Value (cm/s): 5.90E-08

Wood Environment & Infrastructure Solutions

Per: [redacted]

Jorden Wiwcharyk, P.Eng.
Geotechnical Engineer

Reporting of these results constitutes a testing service only.
Engineering interpretation or evaluation of the test results is provided only on written request.

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Sludge Testing Results, ALS Canada Ltd, 2022

Assiniboine Injections Ltd. (Notre Dame De Lourdes)
ATTN: NOEL BOISVERT
Box 160
126 Notre Dame Ave W.
Notre Dame De Lourdes MB R0G 1M0

Date Received: 24-JUN-22
Report Date: 19-JUL-22 07:47 (MT)
Version: FINAL

Client Phone: 204-745-7817

Certificate of Analysis

Lab Work Order #: L2718064
Project P.O. #: NOT SUBMITTED
Job Reference: PAINT LAKE , MB
C of C Numbers:
Legal Site Desc:

[redacted]
Hua Wo
Chemistry Laboratory Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2718064-1	L2718064-2	L2718064-3		
	Description	SLUDGE	SLUDGE	SLUDGE		
	Sampled Date	23-JUN-22	23-JUN-22	23-JUN-22		
	Sampled Time	15:00	15:00	15:00		
	Client ID	CELL 1	CELL 2	DISCHARGE		
Grouping	**Analyte**					
SOIL						
Physical Tests	Loss on Ignition @ 550 C (%)	9	13	10		
	% Moisture (%)	50.5	57.3	60.3		
	Percent Solids (%)	49.5	42.7	39.7		
Leachable Anions & Nutrients	Total Kjeldahl Nitrogen (%)	0.38	0.54	0.30		
	Total Organic Nitrogen (%)	0.321	0.509	0.291		
Plant Available Nutrients	Available Ammonium-N (mg/kg)	541	350	128		
	Available Nitrate-N (mg/kg)	1.6 DLHC	20.4 DLHC	4.3 DLHC		
	Available Phosphate-P (mg/kg)	103	183	107		
Metals	Aluminum (Al) (mg/kg)	24300	34100	28900		
	Antimony (Sb) (mg/kg)	0.34	0.20	0.18		
	Arsenic (As) (mg/kg)	4.81	4.92	5.49		
	Barium (Ba) (mg/kg)	160	178	159		
	Beryllium (Be) (mg/kg)	0.89	1.36	1.01		
	Bismuth (Bi) (mg/kg)	1.92	0.56	0.39		
	Boron (B) (mg/kg)	19.0	26.8	21.0		
	Cadmium (Cd) (mg/kg)	0.458	0.086	0.122		
	Calcium (Ca) (mg/kg)	63900	24600	33800		
	Chromium (Cr) (mg/kg)	61.0	73.4	76.9		
	Cobalt (Co) (mg/kg)	15.8	20.2	25.9		
	Copper (Cu) (mg/kg)	61.7	37.3	37.3		
	Iron (Fe) (mg/kg)	32000	41000	40600		
	Lead (Pb) (mg/kg)	15.6	18.1	15.5		
	Lithium (Li) (mg/kg)	37.3	52.5	40.8		
	Magnesium (Mg) (mg/kg)	22700	16600	17200		
	Manganese (Mn) (mg/kg)	456	528	468		
	Mercury (Hg) (mg/kg)	0.0475	0.0223	0.0171		
	Molybdenum (Mo) (mg/kg)	1.20	0.37	0.51		
	Nickel (Ni) (mg/kg)	85.2	58.8	89.3		
	Phosphorus (P) (mg/kg)	1600	1330	1190		
	Potassium (K) (mg/kg)	5960	8180	6550		
	Selenium (Se) (mg/kg)	0.33	<0.20	<0.20		
	Silver (Ag) (mg/kg)	0.20	0.13	0.11		
	Sodium (Na) (mg/kg)	677	681	687		
	Strontium (Sr) (mg/kg)	71.4	58.7	58.4		
	Sulfur (S) (mg/kg)	2500	1300	1900		
	Thallium (Tl) (mg/kg)	0.316	0.398	0.346		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	Sample ID: L2718064-1 Description: SLUDGE Sampled Date: 23-JUN-22 Sampled Time: 15:00 Client ID: CELL 1	Sample ID: L2718064-2 Description: SLUDGE Sampled Date: 23-JUN-22 Sampled Time: 15:00 Client ID: CELL 2	Sample ID: L2718064-3 Description: SLUDGE Sampled Date: 23-JUN-22 Sampled Time: 15:00 Client ID: DISCHARGE		
SOIL						
Metals	Tin (Sn) (mg/kg)	3.3	1.7	1.3		
	Titanium (Ti) (mg/kg)	984	1230	1080		
	Tungsten (W) (mg/kg)	<0.50	<0.50	<0.50		
	Uranium (U) (mg/kg)	1.65	1.35	1.45		
	Vanadium (V) (mg/kg)	51.9	69.8	63.1		
	Zinc (Zn) (mg/kg)	116	88.8	106		
	Zirconium (Zr) (mg/kg)	13.5	24.6	20.7		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	Sample ID Description Sampled Date Sampled Time Client ID	L2718064-1 SLUDGE 23-JUN-22 15:00 CELL 1	L2718064-2 SLUDGE 23-JUN-22 15:00 CELL 2	L2718064-3 SLUDGE 23-JUN-22 15:00 DISCHARGE		
WASTE							
Physical Tests	Conductivity (EC) (dS m-1)		1.59	1.64	1.54		
	pH (pH)		7.19	7.19	7.04		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Additional Comments for Sample Listed:

Samplenum	Matrix	Report Remarks	Sample Comments
L2718064-1	Soil	Note: Samples analyzed as received and calculated to dry.	
L2718064-2	Soil	Note: Samples analyzed as received and calculated to dry.	
L2718064-3	Soil	Note: Samples analyzed as received and calculated to dry.	

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ETL-N-TOTORG-CALC-SK	Soil	Nitrogen, Total Organic - calculation	APHA 4500 Norg-Calculated as TKN - NH3-N
HG-200.2-CVAA-SK	Soil	Mercury in Soil by CVAAS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAAS.

LOI-550-SK	Soil	Loss on Ignition @ 550 C	CSSS (1993) p.461-462

The sample is air dried at 40C overnight, then ground to < 2mm in particle size using a flail grinder. A portion of the dried and ground sample is dried at 105C overnight, then ignited at 550C for 16-20 hours. Loss on ignition at 550C is reported on a dry sample basis.

Loss on Ignition at 550C can be used as an estimation of Organic Matter (CSSS 2008)

MET-200.2-CCMS-SK	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

Soil/sediment is dried, disaggregated, and sieved (2 mm). Strong Acid Leachable Metals in the <2mm fraction are solubilized by heated digestion with nitric and hydrochloric acids. Instrumental analysis is by Collision / Reaction Cell ICPMS.

Limitations: This method is intended to l berate environmentally available metals. Silicate minerals are not solubilized. Some metals may be only partially recovered (matrix dependent), including Al, Ba, Be, Cr, S, Sr, Ti, Tl, V, W, and Zr. Elemental Sulfur may be poorly recovered by this method. Volatile forms of sulfur (e.g. sulfide, H2S) may be excluded if lost during sampling, storage, or digestion.

MOIST-SK	Soil	Moisture Content	CCME PHC in Soil - Tier 1 (mod)

The weighed portion of soil is placed in a 105°C oven overnight. The dried soil is allowed to cooled to room temperature, weighed and the % moisture is calculated.

N-TOTKJ-COL-SK	Soil	Total Kjeldahl Nitrogen	CSSS (2008) 22.2.3

The soil is digested with sulfuric acid in the presence of CuSO4 and K2SO4 catalysts. Ammonia in the soil extract is determined colrimetrically at 660 nm.

NH4-AVAIL-SK	Soil	Available Ammonium-N	CSSS Carter 6.2 / Comm Soil Sci 19(6)

Ammonium (NH4-N) is extracted from the soil using 2 N KCl. Ammonium in the extract is mixed with hypochlorite and salicylate to form indophenol blue, which is determined colorimetrically by auto analysis at 660 nm.

NO3-AVAIL-SK	Soil	Available Nitrate-N	Alberta Ag / APHA 4500 NO3F

Available Nitrate and Nitrite are extracted from the soil using a dilute calcium chloride solution. Nitrate is quantitatively reduced to nitrite by passing of the sample through a copperized cadmium column. The nitrite (reduced nitrate plus original nitrite) is then determined by diazotizing with sulfanilamide followed by coupling with N-(1-naphthyl) ethylenediamine dihydrochloride. The resulting water soluble dye has a magenta color which is measured at colorimetrically at 520nm.

PH/EC-SK	Waste	pH and Conductivity	APHA 4500-H,2510

pH is measured on the as received, oversaturated waste by pH meter. EC is measured on the filtered extract using a conductivity meter.

PO4-AVAIL-OLSEN-SK	Soil	Available Phosphate-P by Olsen	CSSS (2008) 8

Plant available phosphorus is extracted from air dried soil using a fixed ratio bicarbonate extraction. Phosphorus is determined by colorimetry.

SOLIDS-PCNT-CALC-SK	Soil	Calc. Code for % solids from % moisture	Manual Calculation

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Reference Information

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: Assiniboine Injections Ltd. (Notre Dame De Lourdes)
Box 160 126 Notre Dame Ave W.
Notre Dame De Lourdes MB R0G 1M0
Contact: NOEL BOISVERT

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
HG-200.2-CVAA-SK	**Soil**							
Batch R5819461								
WG3746419-5 CRM		**SCP_SS-2_SOIL**						
Mercury (Hg)			98.5		%		70-130	08-JUL-22
WG3746419-4 DUP		**L2718064-1**						
Mercury (Hg)		0.0475	0.0491		mg/kg	3.4	40	08-JUL-22
WG3746419-3 LCS								
Mercury (Hg)			94.6		%		80-120	08-JUL-22
WG3746419-1 MB								
Mercury (Hg)			<0.0050		mg/kg		0.005	08-JUL-22
LOI-550-SK	**Soil**							
Batch R5818876								
WG3746935-3 DUP		**L2718064-2**						
Loss on Ignition @ 550 C		13	13		%	0.8	20	08-JUL-22
WG3746935-2 IRM		**LOI 2021 SOIL**						
Loss on Ignition @ 550 C			106.7		%		80-120	08-JUL-22
WG3746935-1 MB								
Loss on Ignition @ 550 C			<1		%		1	08-JUL-22
MET-200.2-CCMS-SK	**Soil**							
Batch R5821439								
WG3746419-5 CRM		**SCP SS-2 SOIL**						
Aluminum (Al)			99.2		%		70-130	11-JUL-22
Antimony (Sb)			108.2		%		70-130	11-JUL-22
Arsenic (As)			109.7		%		70-130	11-JUL-22
Barium (Ba)			109.1		%		70-130	11-JUL-22
Beryllium (Be)			90.5		%		70-130	11-JUL-22
Boron (B)			8.6		mg/kg		3.5-13.5	11-JUL-22
Bismuth (Bi)			0.17		mg/kg		0-0.34	11-JUL-22
Cadmium (Cd)			98.6		%		70-130	11-JUL-22
Calcium (Ca)			98.9		%		70-130	11-JUL-22
Chromium (Cr)			94.3		%		70-130	11-JUL-22
Cobalt (Co)			101.7		%		70-130	11-JUL-22
Copper (Cu)			101.6		%		70-130	11-JUL-22
Iron (Fe)			98.2		%		70-130	11-JUL-22
Lead (Pb)			102.4		%		70-130	11-JUL-22
Lithium (Li)			101.4		%		70-130	11-JUL-22
Magnesium (Mg)			97.3		%		70-130	11-JUL-22
Manganese (Mn)			97.6		%		70-130	11-JUL-22

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-SK	**Soil**							
Batch R5821439								
WG3746419-5 CRM		**SCP SS-2 SOIL**						
Molybdenum (Mo)			101.7		%		70-130	11-JUL-22
Nickel (Ni)			103.2		%		70-130	11-JUL-22
Phosphorus (P)			115.2		%		70-130	11-JUL-22
Potassium (K)			100.4		%		70-130	11-JUL-22
Selenium (Se)			0.12		mg/kg		0-0.34	11-JUL-22
Silver (Ag)			95.5		%		70-130	11-JUL-22
Sodium (Na)			111.0		%		70-130	11-JUL-22
Strontium (Sr)			103.2		%		70-130	11-JUL-22
Thallium (Tl)			0.125		mg/kg		0.029-0.129	11-JUL-22
Tin (Sn)			95.6		%		70-130	11-JUL-22
Titanium (Ti)			86.5		%		70-130	11-JUL-22
Uranium (U)			97.8		%		70-130	11-JUL-22
Vanadium (V)			98.0		%		70-130	11-JUL-22
Zinc (Zn)			90.9		%		70-130	11-JUL-22
Zirconium (Zr)			91.0		%		70-130	11-JUL-22
WG3746419-4 DUP		**L2718064-1**						
Aluminum (Al)		24300	23200		mg/kg	4.6	40	11-JUL-22
Antimony (Sb)		0.34	0.24	J	mg/kg	0.10	0.2	11-JUL-22
Arsenic (As)		4.81	4.69		mg/kg	2.6	30	11-JUL-22
Barium (Ba)		160	158		mg/kg	0.9	40	11-JUL-22
Beryllium (Be)		0.89	0.87		mg/kg	2.4	30	11-JUL-22
Boron (B)		19.0	17.1		mg/kg	10	30	11-JUL-22
Bismuth (Bi)		1.92	1.90		mg/kg	1.2	30	11-JUL-22
Cadmium (Cd)		0.458	0.441		mg/kg	3.8	30	11-JUL-22
Calcium (Ca)		63900	64200		mg/kg	0.5	30	11-JUL-22
Chromium (Cr)		61.0	58.1		mg/kg	4.9	30	11-JUL-22
Cobalt (Co)		15.8	16.5		mg/kg	4.4	30	11-JUL-22
Copper (Cu)		61.7	62.8		mg/kg	1.8	30	11-JUL-22
Iron (Fe)		32000	30500		mg/kg	4.8	30	11-JUL-22
Lead (Pb)		15.6	15.3		mg/kg	2.1	40	11-JUL-22
Lithium (Li)		37.3	34.7		mg/kg	7.0	30	11-JUL-22
Magnesium (Mg)		22700	22800		mg/kg	0.5	30	11-JUL-22
Manganese (Mn)		456	443		mg/kg	2.9	30	11-JUL-22
Molybdenum (Mo)		1.20	1.01		mg/kg	17	40	11-JUL-22

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-SK	**Soil**							
Batch R5821439								
WG3746419-4 DUP		**L2718064-1**						
Nickel (Ni)		85.2	85.9		mg/kg	0.9	30	11-JUL-22
Phosphorus (P)		1600	1410		mg/kg	12	30	11-JUL-22
Potassium (K)		5960	5470		mg/kg	8.5	40	11-JUL-22
Selenium (Se)		0.33	0.32		mg/kg	4.4	30	11-JUL-22
Silver (Ag)		0.20	0.24		mg/kg	16	40	11-JUL-22
Sodium (Na)		677	601		mg/kg	12	40	11-JUL-22
Strontium (Sr)		71.4	69.1		mg/kg	3.2	40	11-JUL-22
Sulfur (S)		2500	2300		mg/kg	5.4	30	11-JUL-22
Thallium (Tl)		0.316	0.298		mg/kg	5.7	30	11-JUL-22
Tin (Sn)		3.3	2.7		mg/kg	17	40	11-JUL-22
Titanium (Ti)		984	892		mg/kg	9.7	40	11-JUL-22
Tungsten (W)		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	11-JUL-22
Uranium (U)		1.65	1.63		mg/kg	0.9	30	11-JUL-22
Vanadium (V)		51.9	48.6		mg/kg	6.5	30	11-JUL-22
Zinc (Zn)		116	115		mg/kg	0.6	30	11-JUL-22
Zirconium (Zr)		13.5	13.0		mg/kg	4.0	30	11-JUL-22
WG3746419-3 LCS								
Aluminum (Al)			107.7		%		80-120	11-JUL-22
Antimony (Sb)			103.2		%		80-120	11-JUL-22
Arsenic (As)			101.2		%		80-120	11-JUL-22
Barium (Ba)			106.6		%		80-120	11-JUL-22
Beryllium (Be)			95.7		%		80-120	11-JUL-22
Boron (B)			101.5		%		80-120	11-JUL-22
Bismuth (Bi)			102.3		%		80-120	11-JUL-22
Cadmium (Cd)			103.3		%		80-120	11-JUL-22
Calcium (Ca)			100.4		%		80-120	11-JUL-22
Chromium (Cr)			104.9		%		80-120	11-JUL-22
Cobalt (Co)			106.6		%		80-120	11-JUL-22
Copper (Cu)			101.3		%		80-120	11-JUL-22
Iron (Fe)			112.4		%		80-120	11-JUL-22
Lead (Pb)			104.4		%		80-120	11-JUL-22
Lithium (Li)			97.0		%		80-120	11-JUL-22
Magnesium (Mg)			107.8		%		80-120	11-JUL-22
Manganese (Mn)			104.7		%		80-120	11-JUL-22

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-SK	**Soil**							
Batch R5821439								
WG3746419-3 LCS								
Molybdenum (Mo)			104.6		%		80-120	11-JUL-22
Nickel (Ni)			104.4		%		80-120	11-JUL-22
Phosphorus (P)			110.0		%		80-120	11-JUL-22
Potassium (K)			104.3		%		80-120	11-JUL-22
Selenium (Se)			97.5		%		80-120	11-JUL-22
Silver (Ag)			101.3		%		80-120	11-JUL-22
Sodium (Na)			105.2		%		80-120	11-JUL-22
Strontium (Sr)			106.3		%		80-120	11-JUL-22
Sulfur (S)			105.6		%		80-120	11-JUL-22
Thallium (Tl)			101.9		%		80-120	11-JUL-22
Tin (Sn)			101.2		%		80-120	11-JUL-22
Titanium (Ti)			102.6		%		80-120	11-JUL-22
Tungsten (W)			102.9		%		80-120	11-JUL-22
Uranium (U)			105.4		%		80-120	11-JUL-22
Vanadium (V)			107.9		%		80-120	11-JUL-22
Zinc (Zn)			93.8		%		80-120	11-JUL-22
Zirconium (Zr)			100.4		%		80-120	11-JUL-22
WG3746419-1 MB								
Aluminum (Al)			<50		mg/kg		50	11-JUL-22
Antimony (Sb)			<0.10		mg/kg		0.1	11-JUL-22
Arsenic (As)			<0.10		mg/kg		0.1	11-JUL-22
Barium (Ba)			<0.50		mg/kg		0.5	11-JUL-22
Beryllium (Be)			<0.10		mg/kg		0.1	11-JUL-22
Boron (B)			<5.0		mg/kg		5	11-JUL-22
Bismuth (Bi)			<0.20		mg/kg		0.2	11-JUL-22
Cadmium (Cd)			<0.020		mg/kg		0.02	11-JUL-22
Calcium (Ca)			<50		mg/kg		50	11-JUL-22
Chromium (Cr)			<0.50		mg/kg		0.5	11-JUL-22
Cobalt (Co)			<0.10		mg/kg		0.1	11-JUL-22
Copper (Cu)			<0.50		mg/kg		0.5	11-JUL-22
Iron (Fe)			<50		mg/kg		50	11-JUL-22
Lead (Pb)			<0.50		mg/kg		0.5	11-JUL-22
Lithium (Li)			<2.0		mg/kg		2	11-JUL-22
Magnesium (Mg)			<20		mg/kg		20	11-JUL-22

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-SK	**Soil**							
Batch R5821439								
WG3746419-1 MB								
Manganese (Mn)			<1.0		mg/kg		1	11-JUL-22
Molybdenum (Mo)			<0.10		mg/kg		0.1	11-JUL-22
Nickel (Ni)			<0.50		mg/kg		0.5	11-JUL-22
Phosphorus (P)			<50		mg/kg		50	11-JUL-22
Potassium (K)			<100		mg/kg		100	11-JUL-22
Selenium (Se)			<0.20		mg/kg		0.2	11-JUL-22
Silver (Ag)			<0.10		mg/kg		0.1	11-JUL-22
Sodium (Na)			<50		mg/kg		50	11-JUL-22
Strontium (Sr)			<0.50		mg/kg		0.5	11-JUL-22
Sulfur (S)			<1000		mg/kg		1000	11-JUL-22
Thallium (Tl)			<0.050		mg/kg		0.05	11-JUL-22
Tin (Sn)			<1.0		mg/kg		1	11-JUL-22
Titanium (Ti)			<1.0		mg/kg		1	11-JUL-22
Tungsten (W)			<0.50		mg/kg		0.5	11-JUL-22
Uranium (U)			<0.050		mg/kg		0.05	11-JUL-22
Vanadium (V)			<0.20		mg/kg		0.2	11-JUL-22
Zinc (Zn)			<2.0		mg/kg		2	11-JUL-22
Zirconium (Zr)			<1.0		mg/kg		1	11-JUL-22
MOIST-SK	**Soil**							
Batch R5815378								
WG3746261-3 DUP		**L2718064-2**						
% Moisture		57.3	56.6		%	1.1	20	05-JUL-22
WG3746261-2 LCS								
% Moisture			99.3		%		90-110	05-JUL-22
WG3746261-1 MB								
% Moisture			<0.10		%		0.1	05-JUL-22
N-TOTKJ-COL-SK	**Soil**							
Batch R5819156								
WG3747514-1 DUP		**L2718064-1**						
Total Kjeldahl Nitrogen		0.38	0.38		%	1.5	20	09-JUL-22
WG3747514-2 IRM		**08-109 SOIL**						
Total Kjeldahl Nitrogen			87.7		%		80-120	09-JUL-22
WG3747514-3 LCS								
Total Kjeldahl Nitrogen			88.4		%		80-120	09-JUL-22
WG3747514-4 MB								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
N-TOTKJ-COL-SK	**Soil**							
Batch R5819156								
WG3747514-4 MB								
Total Kjeldahl Nitrogen			<0.020		%		0.02	09-JUL-22
NH4-AVAIL-SK	**Soil**							
Batch R5820317								
WG3746389-3 IRM		**ALS SAL 2019**						
Available Ammonium-N			92.1		%		80-120	08-JUL-22
WG3746389-4 LCS								
Available Ammonium-N			106.0		%		80-120	08-JUL-22
WG3746389-2 MB								
Available Ammonium-N			<1.0		mg/kg		1	08-JUL-22
NO3-AVAIL-SK	**Soil**							
Batch R5822464								
WG3747484-1 DUP		**L2718064-2**						
Available Nitrate-N		20.4	20.3		mg/kg	0.7	30	14-JUL-22
WG3747484-3 IRM		**ALS SAL 2019**						
Available Nitrate-N			91.4		%		70-130	14-JUL-22
WG3747484-4 LCS								
Available Nitrate-N			105.0		%		70-130	14-JUL-22
WG3747484-2 MB								
Available Nitrate-N			<1.0		mg/kg		1	14-JUL-22
PO4-AVAIL-OLSEN-SK	**Soil**							
Batch R5821952								
WG3747513-1 DUP		**L2718064-3**						
Available Phosphate-P		107	102		mg/kg	4.9	30	12-JUL-22
WG3747513-3 IRM		**FARM2005**						
Available Phosphate-P			92.9		%		80-120	12-JUL-22
WG3747513-4 LCS								
Available Phosphate-P			93.5		%		80-120	12-JUL-22
WG3747513-2 MB								
Available Phosphate-P			<1.0		mg/kg		1	12-JUL-22
PH/EC-SK	**Waste**							
Batch R5819936								
WG3746262-4 DUP		**L2718064-1**						
pH		7.19	7.19	J	pH	0.00	0.3	09-JUL-22
Conductivity (EC)		1.59	1.65		dS m-1	3.9	20	09-JUL-22
WG3746262-1 MB								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC-SK	**Waste**							
Batch R5819936								
WG3746262-1 MB								
Conductivity (EC)			<0.20		dS m-1		0.2	09-JUL-22

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Plant Available Nutrients							
Available Nitrate-N							
	1	23-JUN-22 15:00	04-JUL-22 13:00	3	11	days	EHT
	2	23-JUN-22 15:00	04-JUL-22 13:00	3	11	days	EHT
	3	23-JUN-22 15:00	04-JUL-22 13:00	3	11	days	EHT

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2718064 were received on 24-JUN-22 15:54.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

12 - 1329 Niakwa Rd. E.
Winnipeg, Manitoba R2J
Tel: (204) 255-9720
Fax: (204) 255-9721
Toll Free: 1 800 607 7555

L2718064-COFC

Chain of Custody / Analytical Request Form

WORK ORDER NO: _____

FOR LABORATORY USE ONLY

LAB NO.: _____

Sample Condition Upon Receipt: ☐ ACCEPTABLE ☐ NON ACCEPTABLE

DATE RECEIVED: JUN 24 2022

☐ Frozen ☐ Cold ☐ Ambient ☐ Broken ☐ Leakage ☐ Incorrect Sample Container

TIME RECEIVED: 3:54 pm

COMMENT: _____

BY: Mg TEMP: 24.1

Date Sampled: June 23 Time: 3 : 00 A.M. ☐ P.M. ☑

Date Required: _____

Location: Paint Lake Mb. (Town, Community, City)

Submitter's Name Printed: _____

Sample Submitted By: _____

Community Code Number: _____

Rural Municipality/LGC/UVD: _____

SAMPLE TYPE

DRINKING WATER
- ☐ Untreated Well
- ☐ Treated Well
- ☐ Treated Municipal
- ☐ Non-Treated Municipal
- ☐ Water-Surface-Raw
- ☐ Water-Surface-Treated

NON-DRINKING WATER
- ☑ Sewage/Waste Water
- ☐ Lake/River
- ☐ Swimming Pool
- ☐ Whirl Pool
- ☐ Other: _____

PURPOSE OF TEST
☐ Private ☐ Real Estate ☐ Water Main

PLEASE PRINT & PRESS FIRMLY

NOTES & CONDITIONS
1. Quote number **MUST BE** provided to insure proper pricing.
2. Failure to properly complete all portions of this form may delay analysis.
3. ALS's liability limited to cost of analysis.

SERVICE REQUESTED
☐ REGULAR ☐ PRIORITY (50% SURCHARGE) ☐ EMERGENCY (100% SURCHARGE) ☐ SAME DAY (200% SURCHARGE)

LAB NUMBER	SAMPLE IDENTIFICATION
	1 cell one
	2. cell two
	3. Discharge
	For all 3 Samples
	Conductivity
	PH
	total Voladile Solids (mg/L)
	total Solids (mg/L)
	Nitrate-nitrogen
	TKN
	Ammonia nitrogen
	Organic nitrogen
	phosphorus, total
	Arsenic, total
	Cadmium, total
	Chromium "
	Copper "
	Lead "
	mercury "
	Nickel "
	Potassium "
	Zinc "

Analyses required

ALS CUSTOMER #: _____ *QUOTE #:* _____

REPORT TO BE SENT TO

NAME: Noel Baisuert
COMPANY: Assiniboine Injections Ltd.
ADDRESS: Notre Dame Mb
CITY/TOWN: _____ / PROV.: Mb.
POSTAL CODE: R0G 1M0
PHONE: 204 745-7817
BY: MAIL ☐ FAX ☐ _____ (FAX NUMBER)
E-MAIL ☑ info@laggercleaning.com (EMAIL ADDRESS)

CC
NAME: _____
ADDRESS: _____
CITY/TOWN: _____ / PROV.: _____
POSTAL CODE: _____
PHONE: _____
BY: MAIL ☐ FAX ☐ _____ (FAX NUMBER)
E-MAIL ☐ _____ (EMAIL ADDRESS)

BILLING ADDRESS SAME AS REPORT TO ☐

NAME: _____
COMPANY: _____
ADDRESS: _____
CITY/TOWN: _____ / PROV.: _____
POSTAL CODE: _____

PAYMENT PARTICULARS (CASH NOT ACCEPTED)

☐ INVOICE NEEDED / CLIENT'S P.O. NO. _____
☐ INTERAC
☐ CHEQUE Subtotal $ _____
☐ VISA G.S.T. $ _____
☐ MASTERCARD Total $ _____

* OUR POLICY IS NOT TO ACCEPT SAMPLES FROM THE PRIVATE CITIZEN WITHOUT PREPAYMENT

ENTERED IN LIMS BY: _____

SAMPLING INSTRUCTIONS ON REVERSE SIDE

ALS ENVIRONMENTAL
12 - 1329 Niakwa Rd. E., Winnipeg, MB Canada R2J 3T4
Phone: +1 204 255 9720 Fax: +1 204 255 9721 **www.alsglobal.com**
A Campbell Brothers Limited Company

SUBMITTER COPY

Sludge Survey, Assiniboine Injections Ltd, 2022

Assiniboine Injections Ltd.
BOX 160, 177 Notre Dame Ave
Notre Dame de Lourdes, MB, R0G 1M0
PH: 204-248-2559 FAX: 204-248-2799
Email: info@lagooncleaning.com

Biosolids Survey

Location
Paint Lake
55.499042, -98.026795

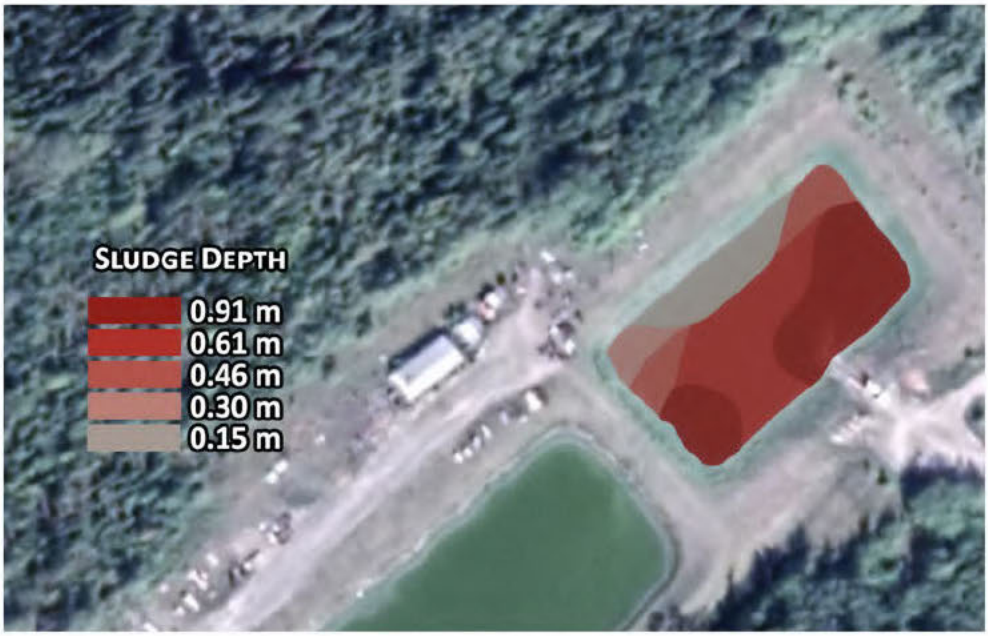
Date Measured - June 23, 2022

Paint Lake Primary Cell

Average Sludge Depth
0.70 meters

Sludge Volume
3,150 m³

Cell Dimensions
57m x 95m

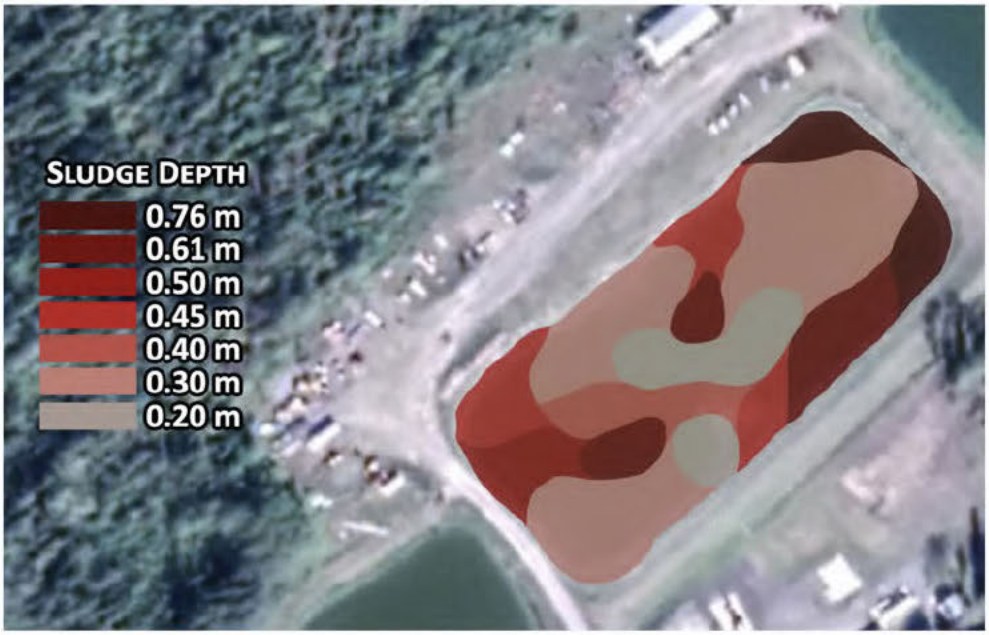


Paint Lake Secondary Cell

Average Sludge Depth
0.39 meters

Sludge Volume
3,699 m³

Cell Dimensions
60m x 140m



All measurements are taken from a watercraft within the cell and surveyed using a grid pattern. Our surveyors probe the bottom of the cell obtaining accurate measurements using physical measuring tools. The sludge depth is determined by gauging the top of the sludge blanket to the base of the lagoon.

Paint Lake
Third Cell

Average Sludge Depth
0.33 meters

Sludge Volume
732.6 m³

Cell Dimensions
43m x 60m

All measurements are taken from a watercraft within the cell and surveyed using a grid pattern. Our surveyors probe the bottom of the cell obtaining accurate measurements using physical measuring tools. The sludge depth is determined by gauging the top of the sludge blanket to the base of the lagoon.

Appendix C

Plan 1:	Proposed Lagoon Expansion Location with Setbacks
Plan 2:	Lagoon Discharge Route
Plan 3:	Proposed Lagoon Expansion Layout
Plan 4:	Proposed Lagoon Expansion Cross Sections

SCALE BAR
(IN METRES)

80 0 40 80 160 240 320 400

1:4000

No.	REVISIONS	DATE	INITIALS

B.M. EL.

LOCATIONS OF UNDERGROUND STRUCTURES/UTILITIES AS SHOWN ARE BASED ON AVAILABLE INFORMATION BUT NO GUARANTEE IS GIVEN OR IMPLIED THAT ALL EXISTING UNDERGROUND STRUCTURES/UTILITIES ARE SHOWN OR THAT THE GIVEN LOCATIONS ARE EXACT. CONFIRMATION OF EXISTENCE AND EXACT LOCATION OF ALL UNDERGROUND STRUCTURES/UTILITIES MUST BE OBTAINED FROM THE APPROPRIATE AUTHORITY/OWNER, BY THE CONTRACTOR, BEFORE PROCEEDING WITH CONSTRUCTION.

ENGINEER'S SEAL

PRELIMINARY

JR Cousin Consultants Ltd.
91A Scurfield Blvd. Winnipeg MB R3Y 1G4
p. (204) 489-0474
f. (204) 489-0487
www.jrcc.ca
ENGINEERING CONSULTANTS
ENGINEERING EXCELLENCE SINCE 1981

CODE:	P-426.02
DESIGNED BY:	BM
DRAWN BY:	OT
REVIEWED BY:	JRC

PROJECT:
PAINT LAKE PROVINCIAL PARK LAGOON
ENVIRONMENT ACT PROPOSAL

TITLE:
PROPOSED LAGOON EXPANSION LOCATION WITH SETBACKS

SCALE:	DATE:	PLAN:	SHEET:
1:4000	22/10/05	1	1 of 4

Oct 12, 2022 - 9:36am G:\426\426 Paint Lake PP\426.02 Wastewater Lagoon Study and EAP\04 Drawings\Acad\EAP\Plan 1.dwg

SCALE BAR
(IN METRES)
120 0 60 120 240 360 480 600
1:6000

No.	REVISIONS	DATE	INITIALS

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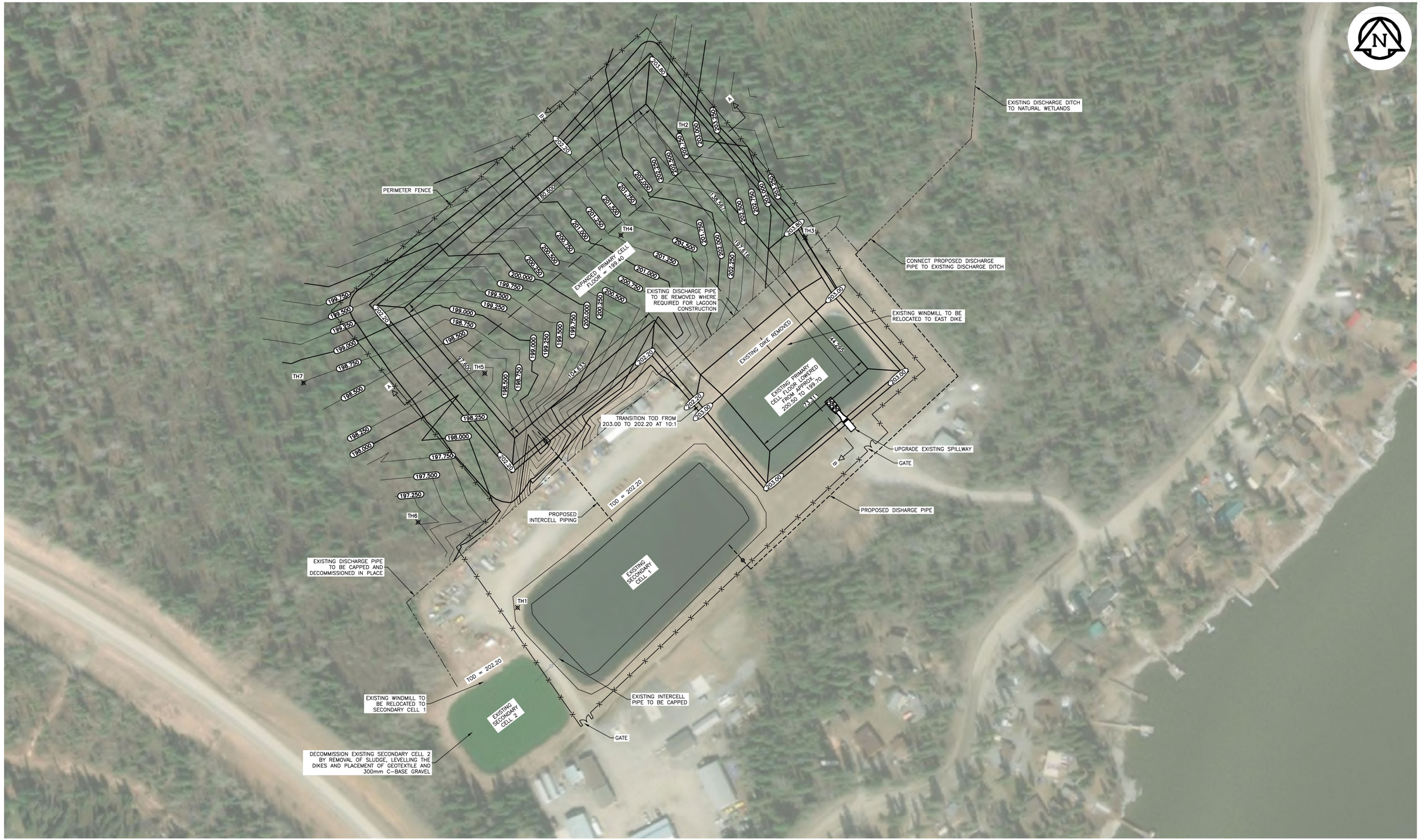
DESIGNED BY:	BM
DRAWN BY:	OT
REVIEWED BY:	JRC

PROJECT:
PAINT LAKE PROVINCIAL PARK LAGOON
ENVIRONMENT ACT PROPOSAL

TITLE:
LAGOON DISCHARGE ROUTE

SCALE:	DATE:	PLAN:	SHEET:
1:6000	22/10/06	2	2 of 4



SCALE BAR
(IN METRES)

20 0 10 20 40 60 80 100

1:1000

No.	REVISIONS	DATE	INITIALS
			B.M. EL.

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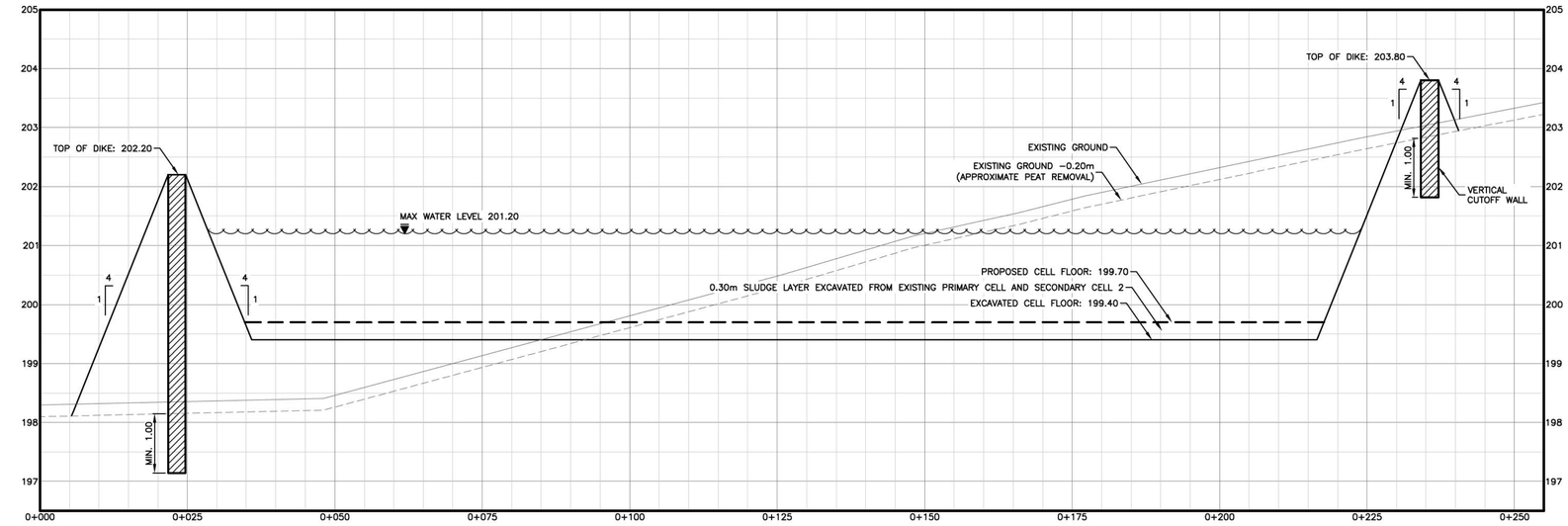
CODE:	P-426.02
DESIGNED BY:	BM
DRAWN BY:	OT
REVIEWED BY:	JRC

PROJECT: PAINT LAKE PROVINCIAL PARK LAGOON ENVIRONMENT ACT PROPOSAL

TITLE: PROPOSED LAGOON EXPANSTION LAYOUT

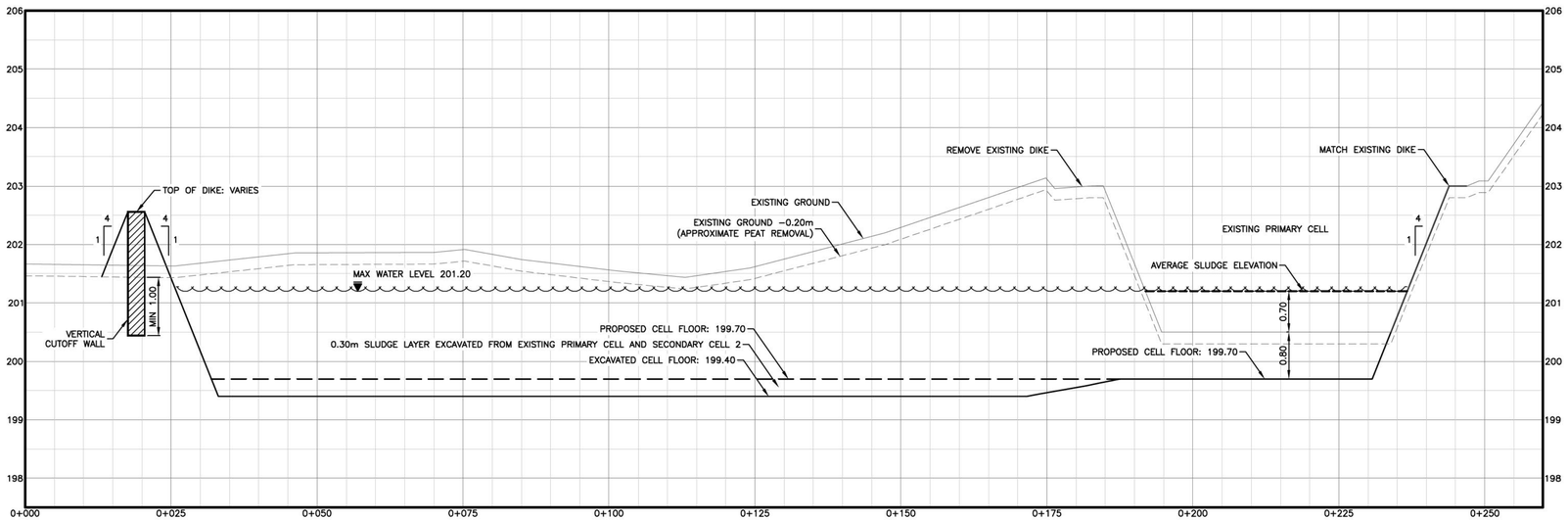
SCALE:	DATE:	PLAN:	SHEET:
1:1000	22/10/06	3	3 of 4

Oct 12, 2022 - 8:38am O:\400\426 Paint Lake PP\426.02 Wastewater Lagoon Study and EAP\04 Drawings\dwg\EAP\Rev 3, Plan 4.dwg



CROSS SECTION A

SCALE = V: 1:50
H: 1:500



CROSS SECTION B

SCALE = V: 1:50
H: 1:500

No.	REVISIONS	DATE	INITIALS

B.M. EL.

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DESIGNED BY:	BM
DRAWN BY:	OT
REVIEWED BY:	JRC

PROJECT: PAINT LAKE PROVINCIAL PARK LAGOON ENVIRONMENT ACT PROPOSAL

TITLE: PROPOSED LAGOON EXPANSION CROSS SECTIONS

SCALE:	DATE:	PLAN:	SHEET:
AS NOTED	22/10/06	4	4 of 4